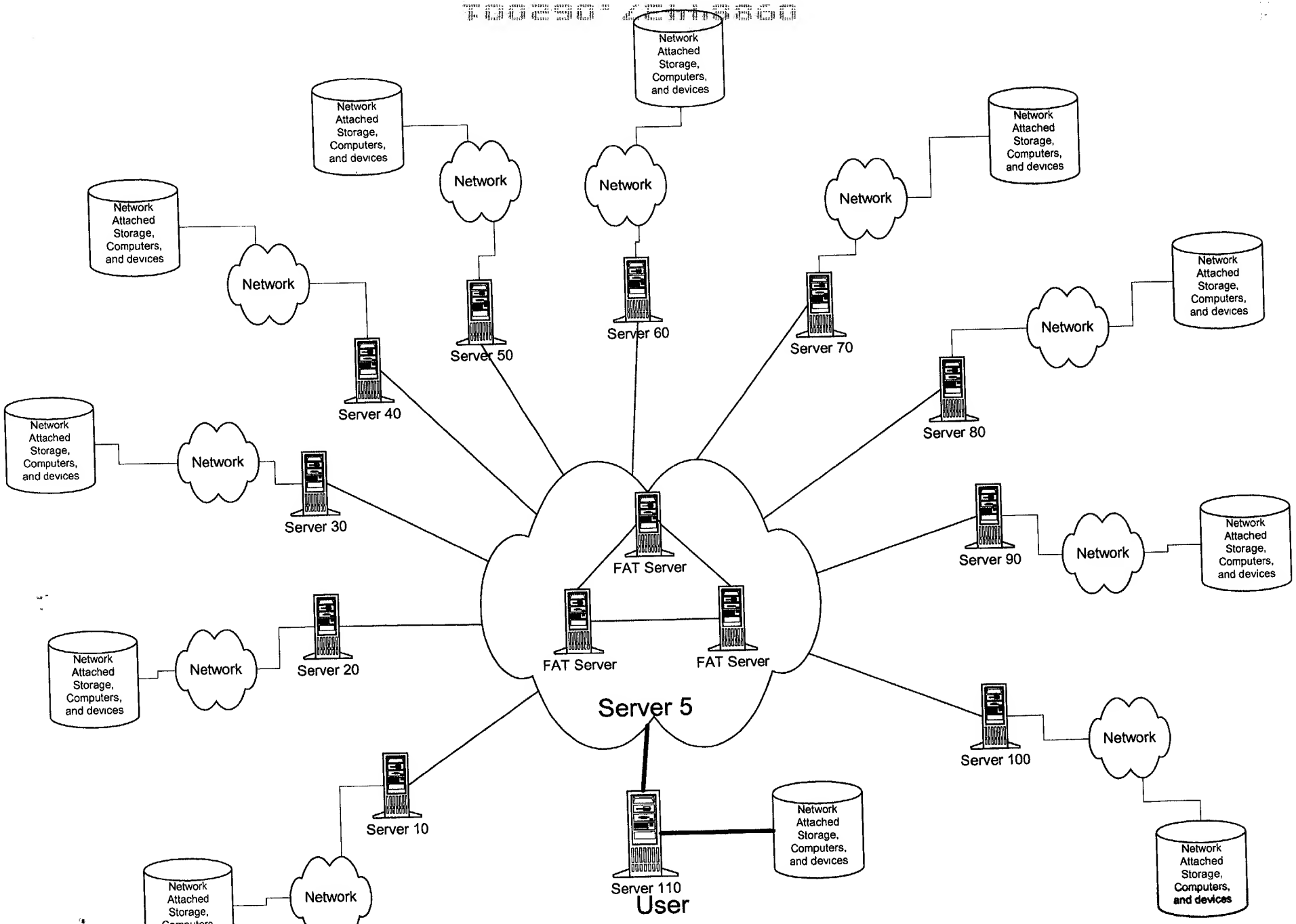

Network Attached Storage, Computers, and devices
Network
Server 50
Server 60
Server 70
Server 80
Server 90
Server 100
Server 110
Server 40
Server 30
Server 20
Server 10
FAT Server
FAT Server
FAT Server
Server 5
User

Figure 1a

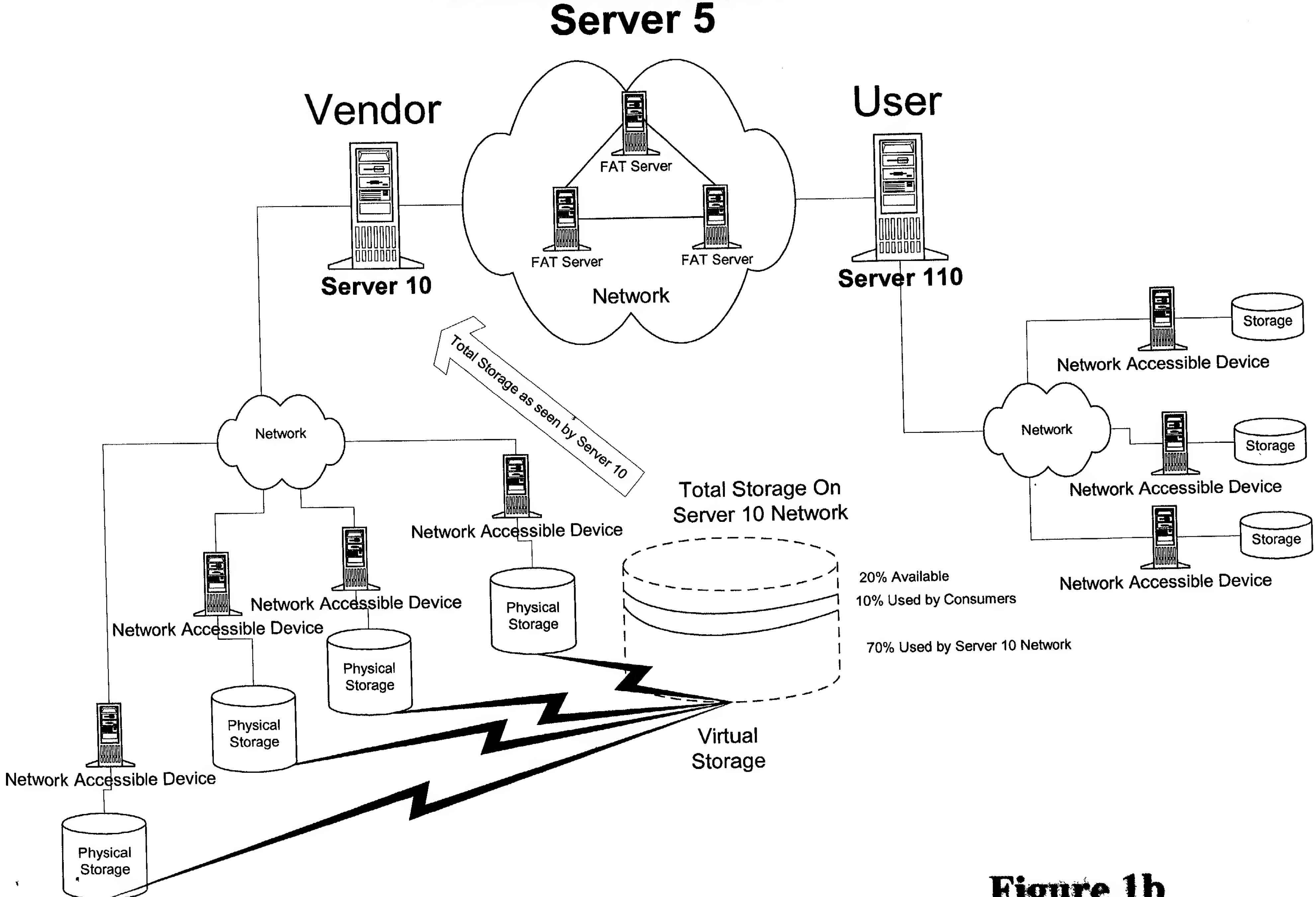

Server 5
Vendor
User
FAT Server
FAT Server
FAT Server
Network
Server 10
Server 110
Total Storage as seen by Server 10
Network
Network
Network Accessible Device
Network Accessible Device
Network Accessible Device
Network Accessible Device
Physical Storage
Physical Storage
Physical Storage
Physical Storage
Total Storage On Server 10 Network
20% Available
10% Used by Consumers
70% Used by Server 10 Network
Virtual Storage
Network
Storage
Storage
Storage
Network Accessible Device
Network Accessible Device
Network Accessible Device

Figure 1b

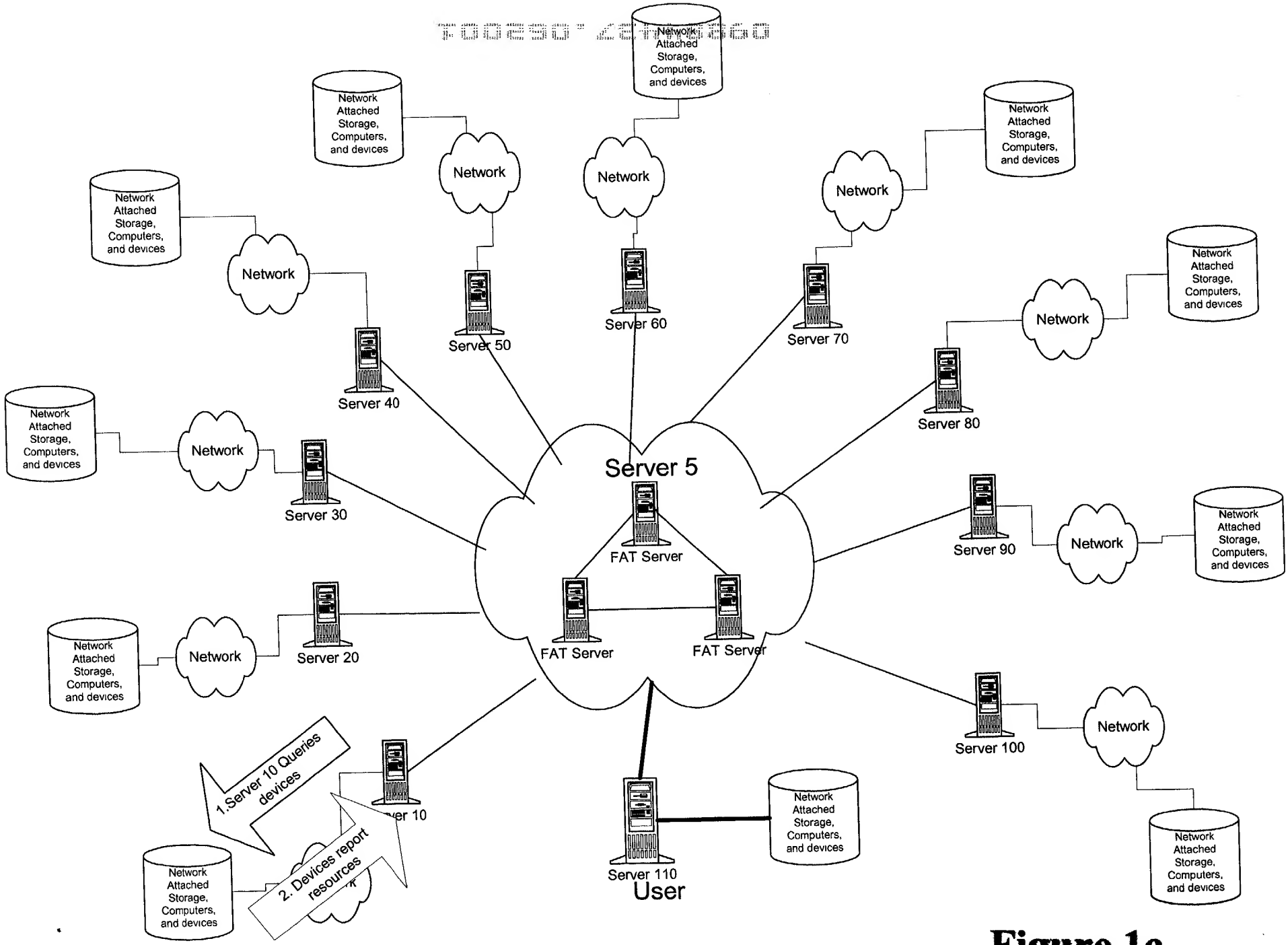
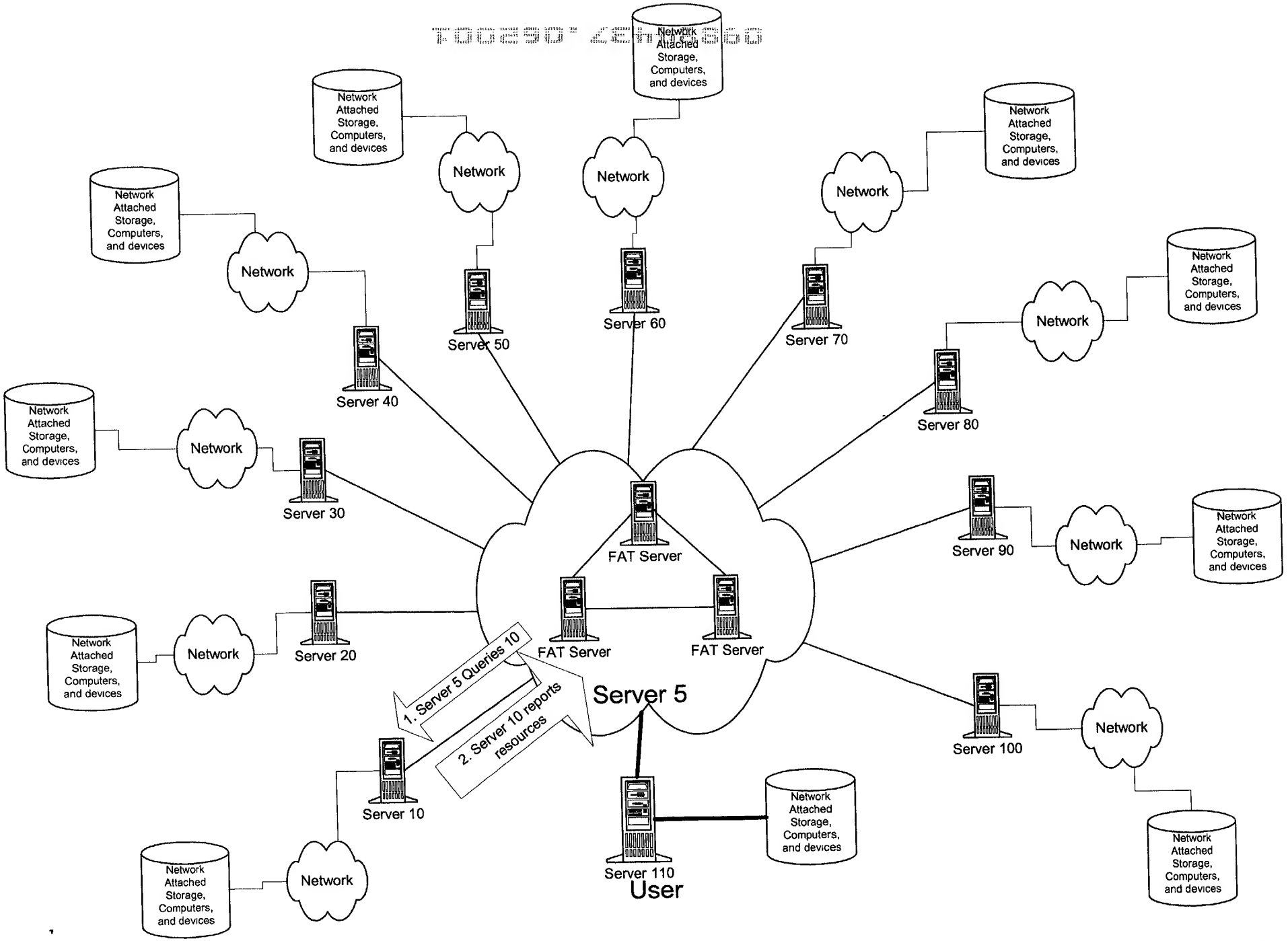


Figure 1c

Networked attached storage devices report to attached server.



Vendor Servers wishing to offer storage report their resources to Server 5 for compiling a comprehensive File Allocation Table.

Figure 2

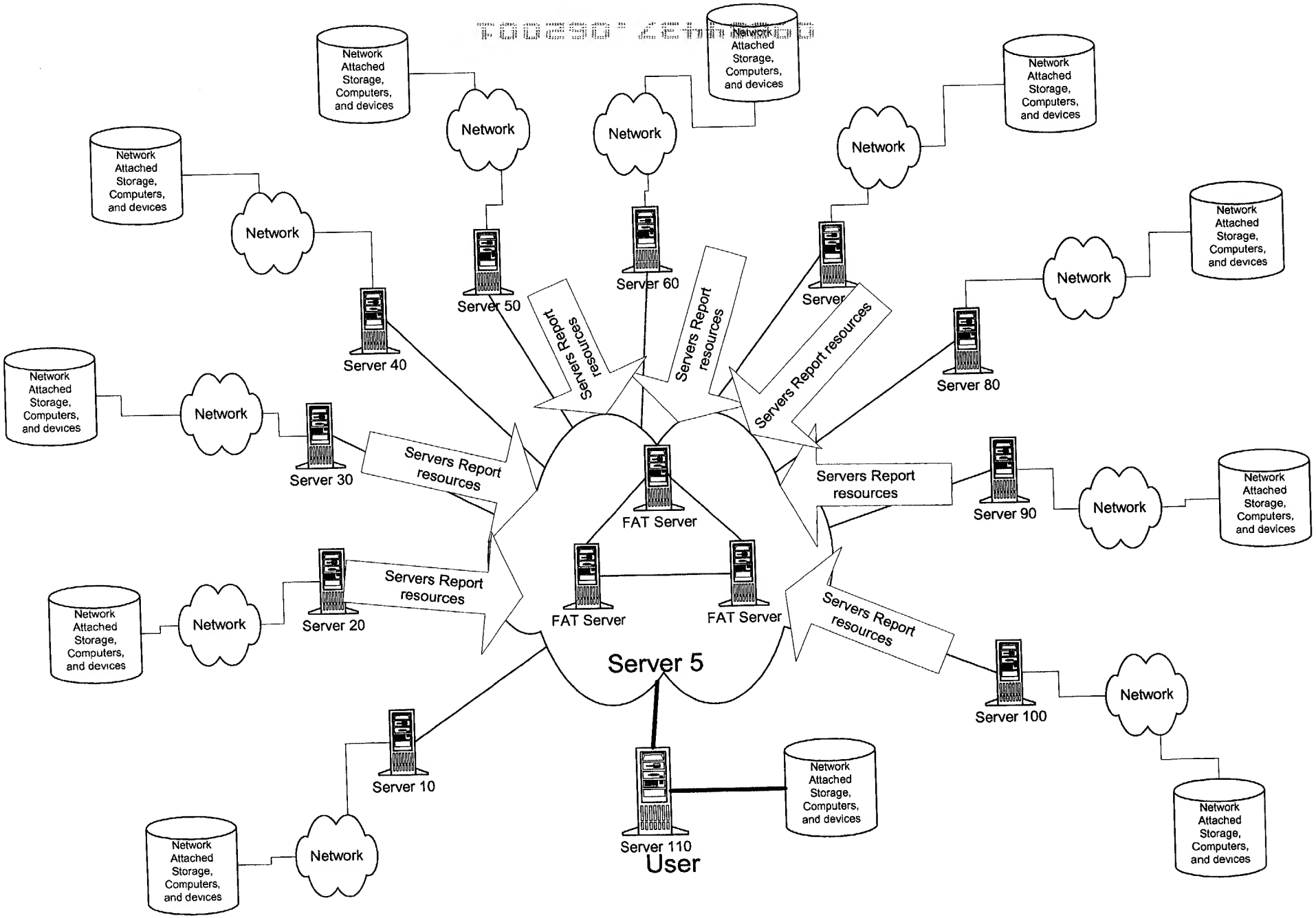
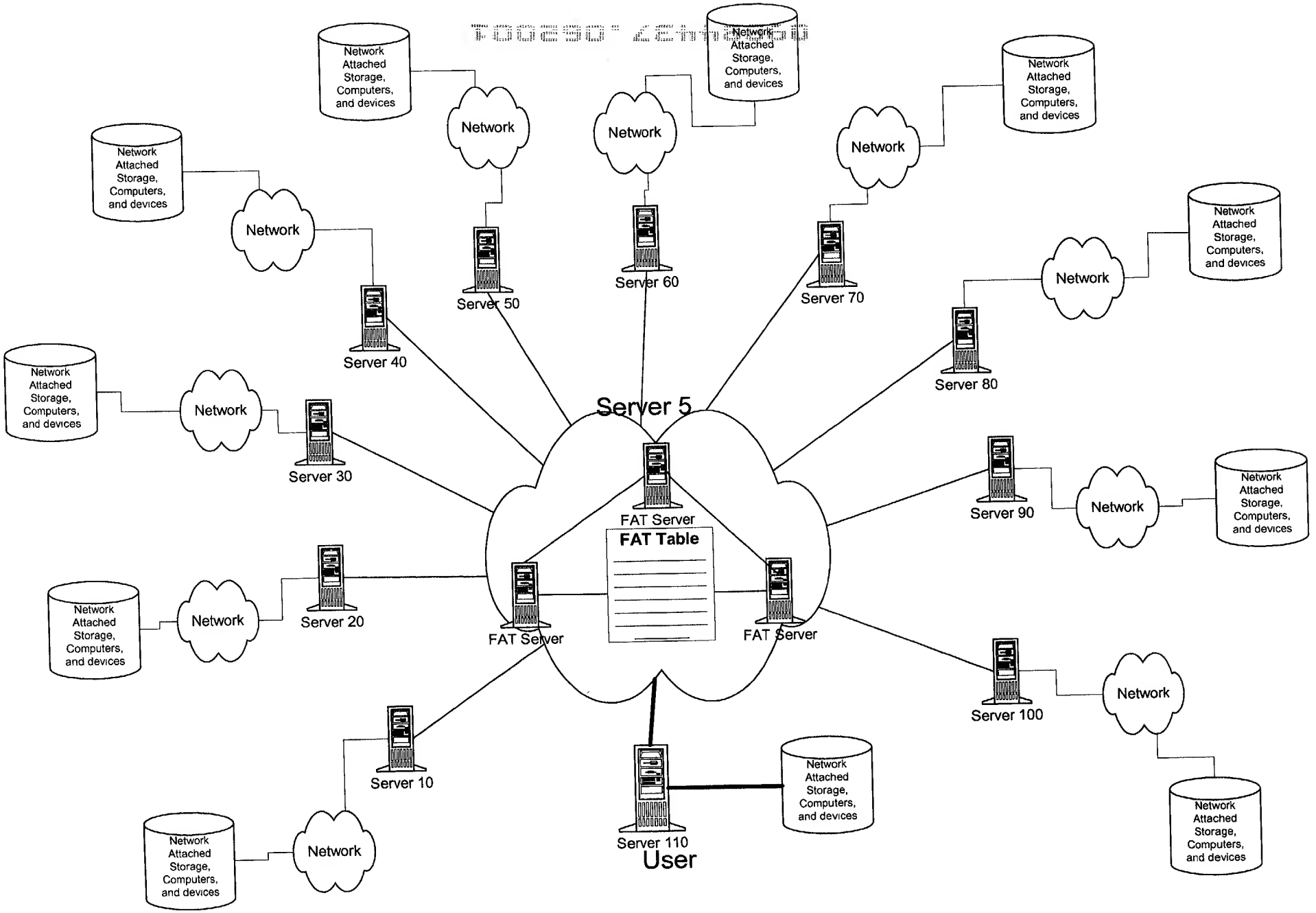


Figure 3

Vendor Servers wishing to offer storage report their resources to Server 5 for compiling a comprehensive File Allocation Table.



Server 5 forms comprehensive File Allocation Table identifying all storage available on the network, and the characteristics of each storage location.

Figure 4

Network Address where storage can accessed

The bandwith available between server location and network (the proverbial "last mile")

The aggregated total of storage capacity available from all the network accessible devices, via the particular server location.

An expression of the cost of sending data to the server location. The cost metric reflects the servers bandwith usage, capacity, latency, and other factors. Used to allocate data storage with the least harm to a servers resources

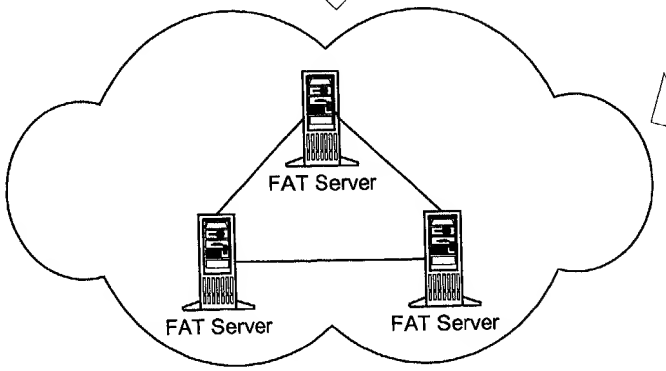
Describes the servers desirability as a storage location. For example, a professional storage service provider location might rank "A", where as a small private business providing storage might be a "D".

Identification of Server

Describes how many network attached storage devices are located at server.

File Allocation Table

Server ID	Network Address	Bandwith Available	Storage Capacity	Cost Metric	Class	Nodes
Server 10	192.168.0.1	T-1	527 GigBytes	1.14	D	23
Server 20	203.144.3.1	OC-4	1233 GigBytes	.14	B	121
Server 30	122.11.65.2	T-3	332 GigBytes	.25	B	34
Server 40	6.45.23.122	Oc-48	2655 GigBytes	.03	A	1229
Server 50	34.3.45.122	OC-128	988	.87	A	34
Server 60	193.210.201.222	Ethernet	220	1.1	C	22
Server 70	24.0.251.1	T-1	1344	2.4	F	12
Server 80	98.112.1.22	OC-128	9234	.01	A	4532
Server 90	210.75.39.122	T-3	120	.8	B	33
Server 100	3.45.111.2	GigEthernet	1533	.7	C	154
...etc						



Server 5

Allocated Storage Table

Users with data stored on Network	Information regarding Data
User Server x	Data locations
User Server y	Data locations
User Server z	Data locations
User Server xx	Data locations
User Server yy	Data locations
User Server zz	Data locations
User Server a	Data locations
User Server b	Data locations
User Server c	Data locations
User Server d	Data locations

File allocation Table is formed, using information reported from Servers 10-100, servers also hold tables of data allocated and stored on the system.

Figure 4a

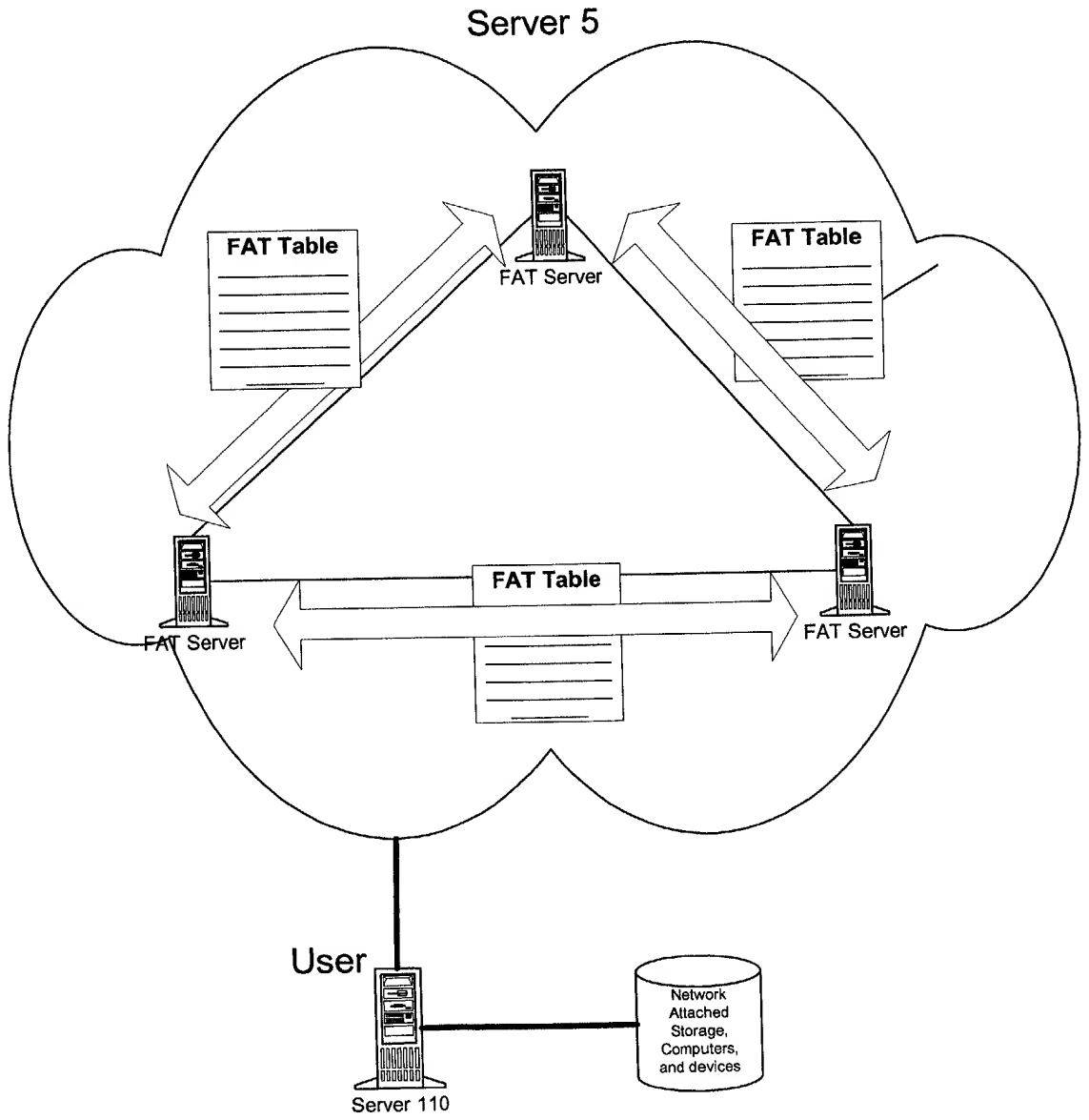


Figure 4b

Server 5 consists of several computing systems, for redundancy and availability of the FAT tables. The FAT tables are therefore mirrored on each individual FAT server. Each individual FAT server will have the same data.

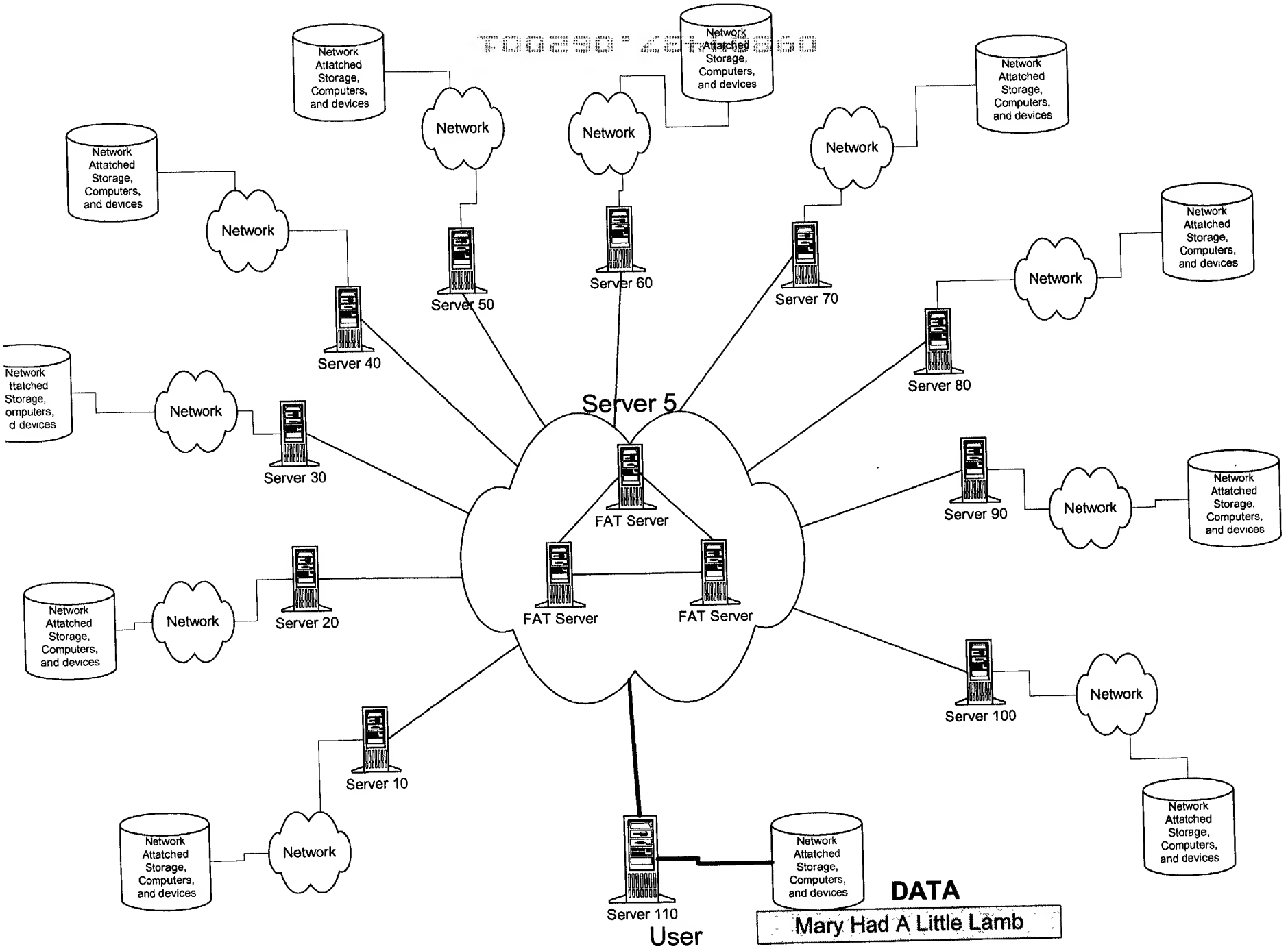
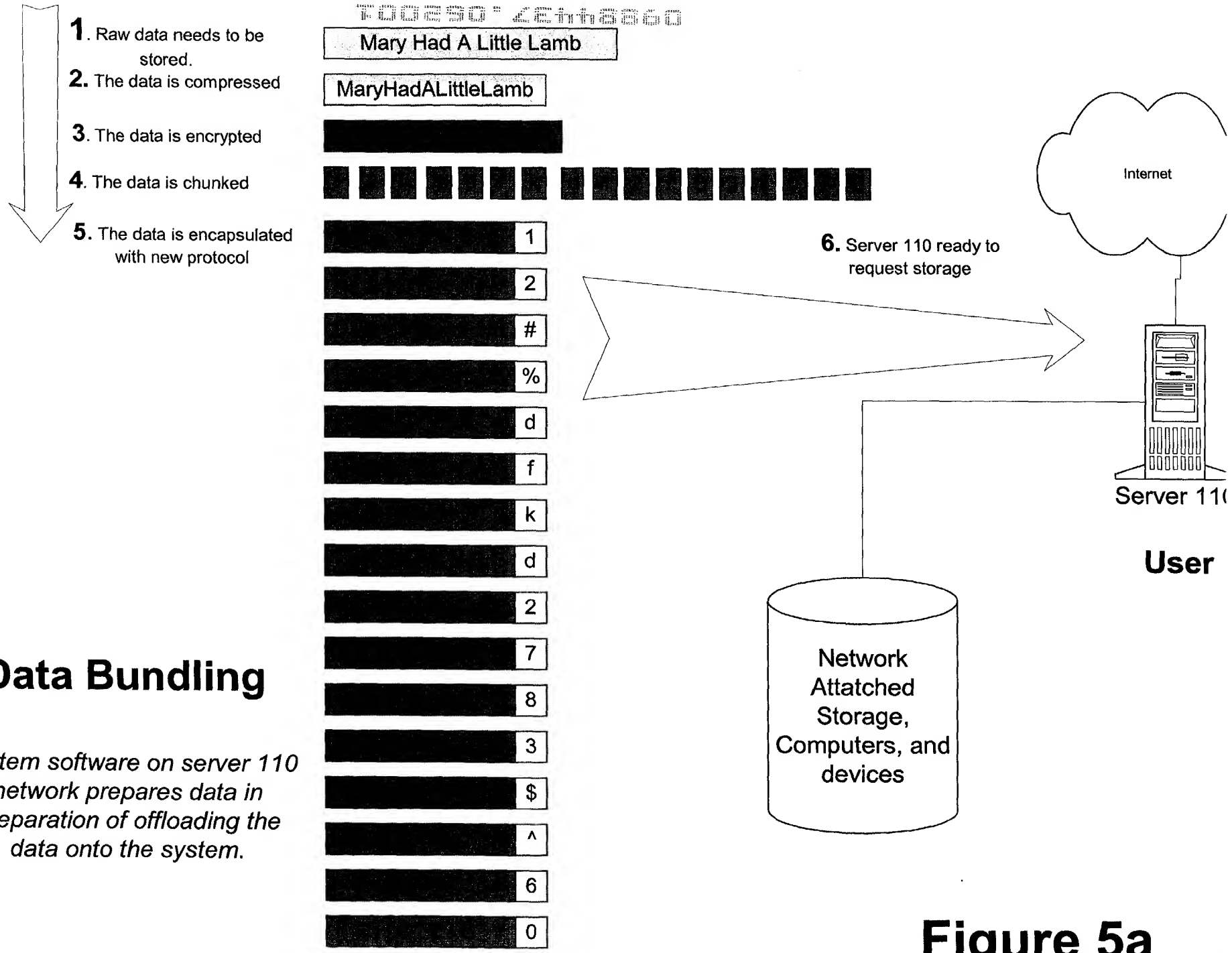


Figure 5

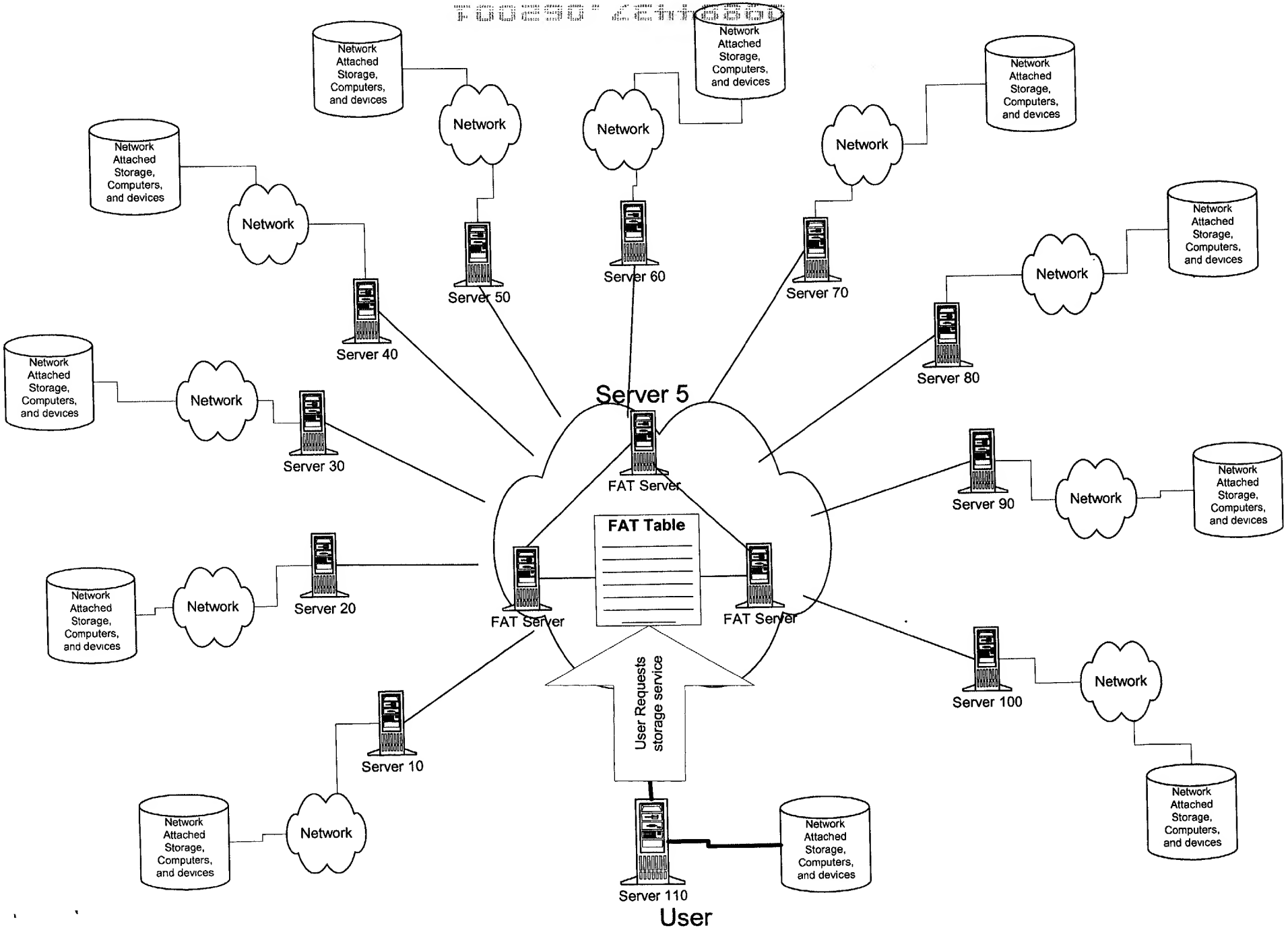
User , Server 110, requires storage services, either for itself, or for a network attatched device on the Server 110 network.



Data Bundling

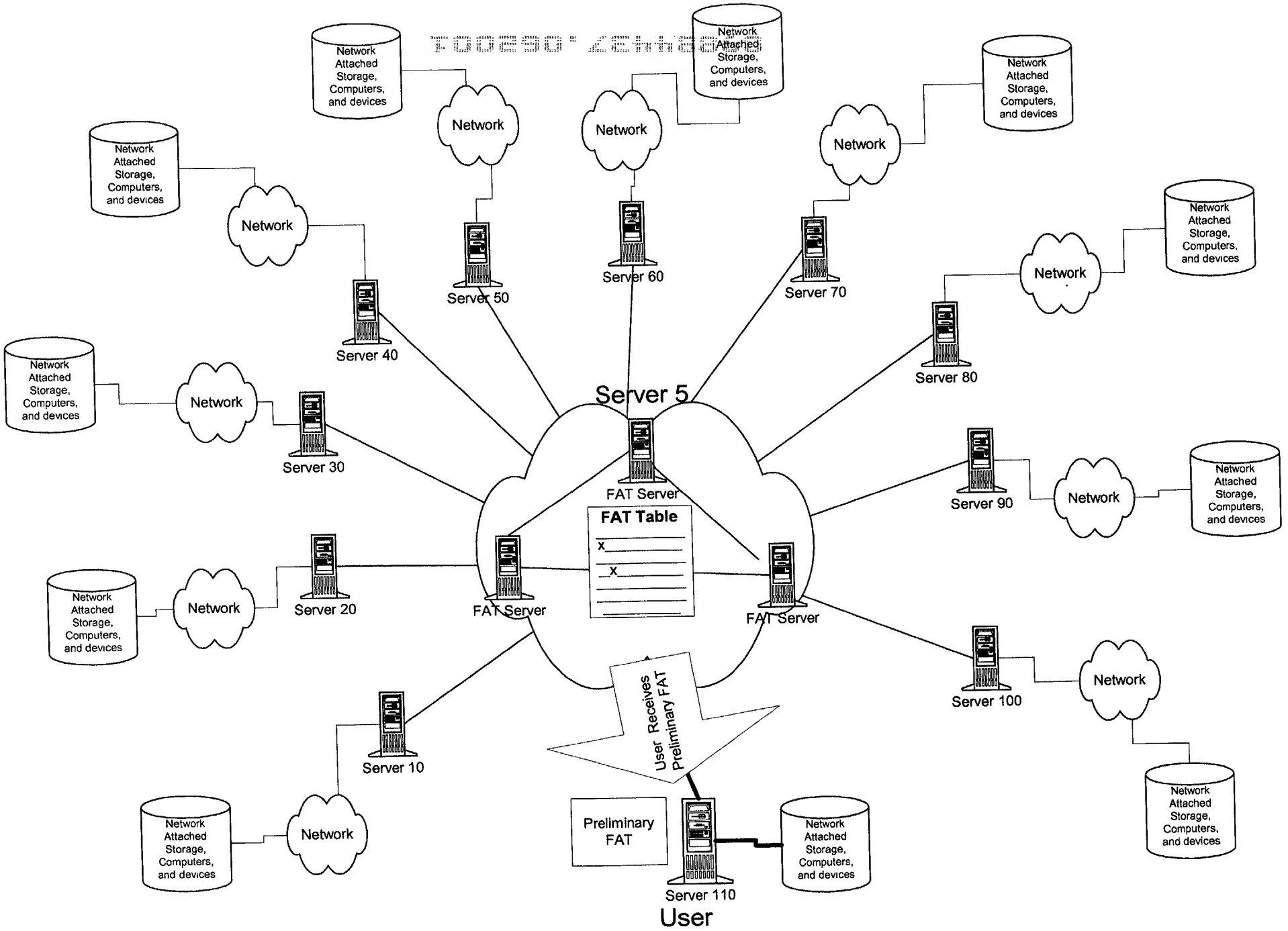
System software on server 110 network prepares data in preparation of offloading the data onto the system.

Figure 5a



User requests storage service, requires a portion of the storage found in the File Allocation Table found on Server 5

Figure 6



Server 5, the File Allocation Servers, sends Server 110 a provisional FAT table, allocating storage space. Server 5 marks on the central FAT which records it has released to server 110, and locks those storage records so that no other user can use those storage resources.

Figure 7

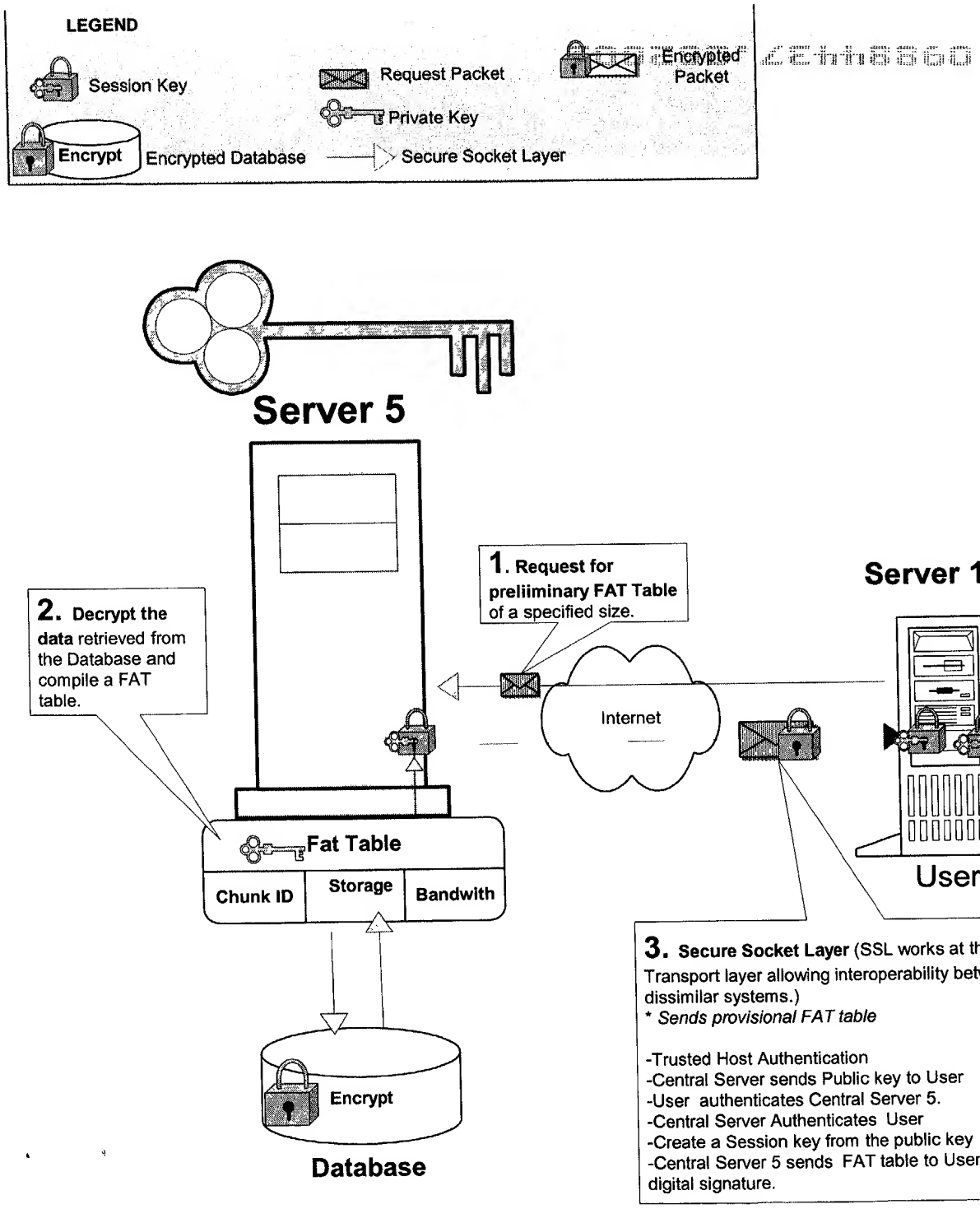
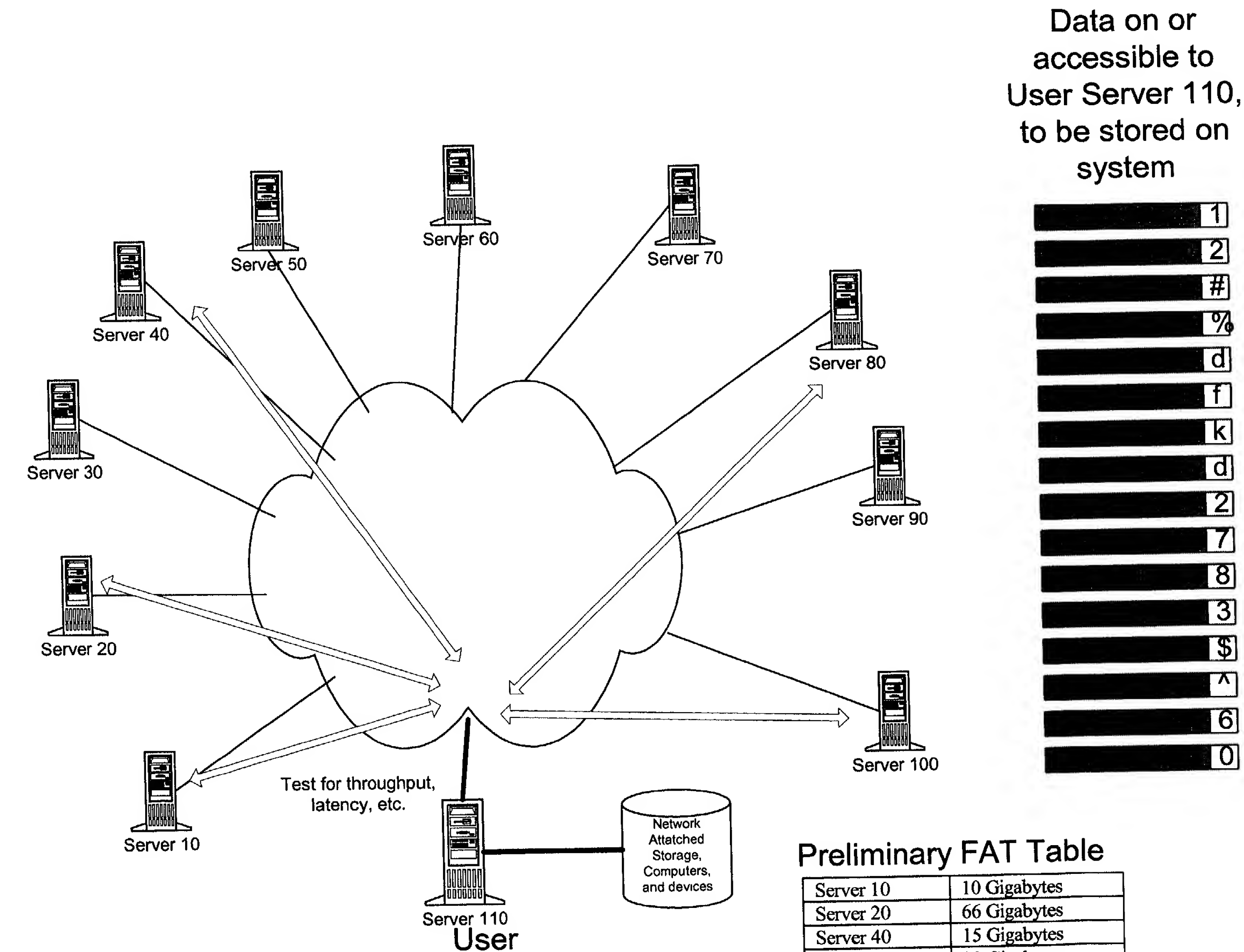


Figure 7a

User requests storage service, requires a portion of the storage found in the File Allocation Table found on Server 5

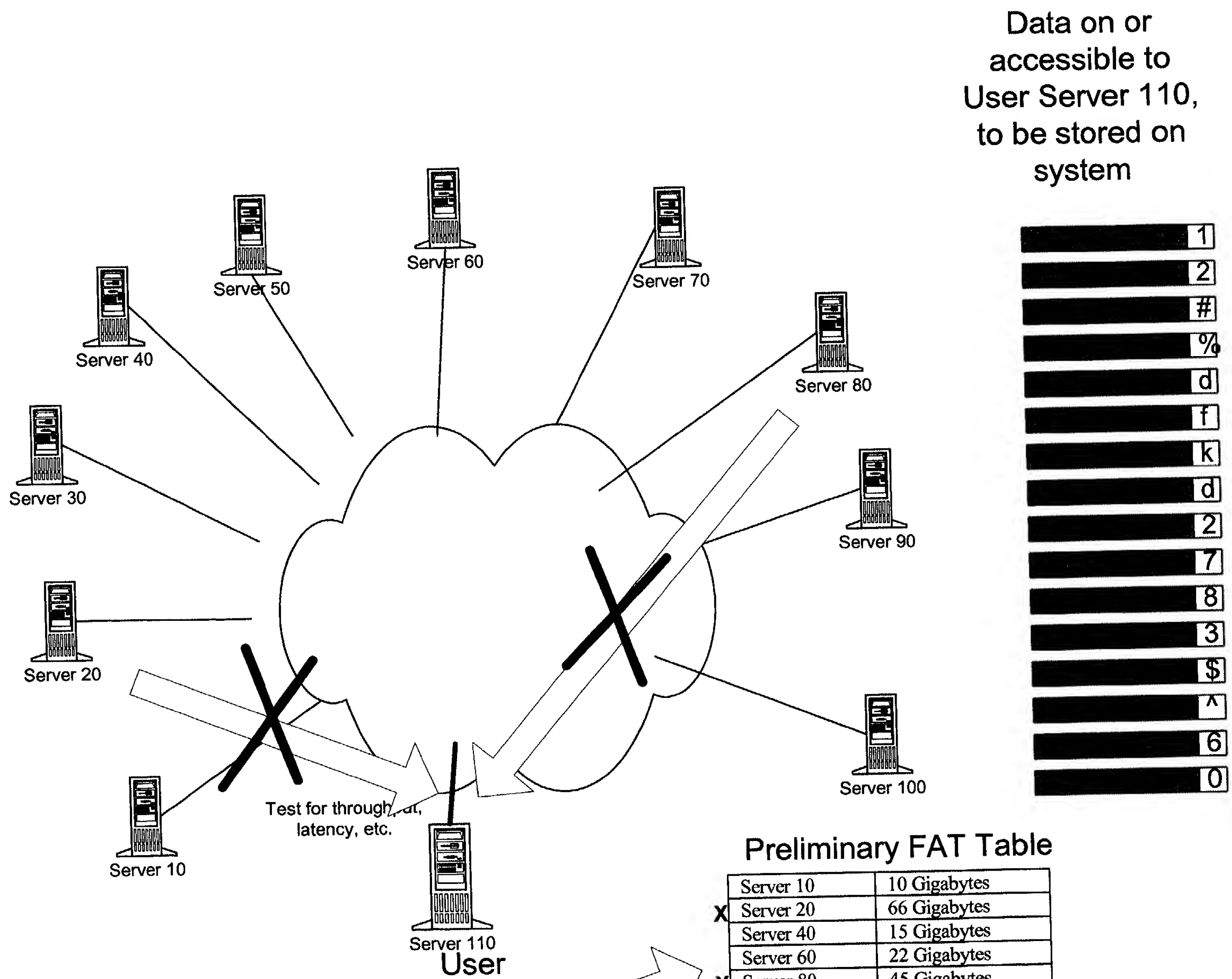


Preliminary FAT Table

Server 10	10 Gigabytes
Server 20	66 Gigabytes
Server 40	15 Gigabytes
Server 60	22 Gigabytes
Server 80	45 Gigabytes
Server 100	22 Gigabytes

The user, Server 110, searches for an optimum path to offload data. Server 110 checks each potential location in the provisional FAT table paths for optimimu path; latency, hop count, availability, etc.

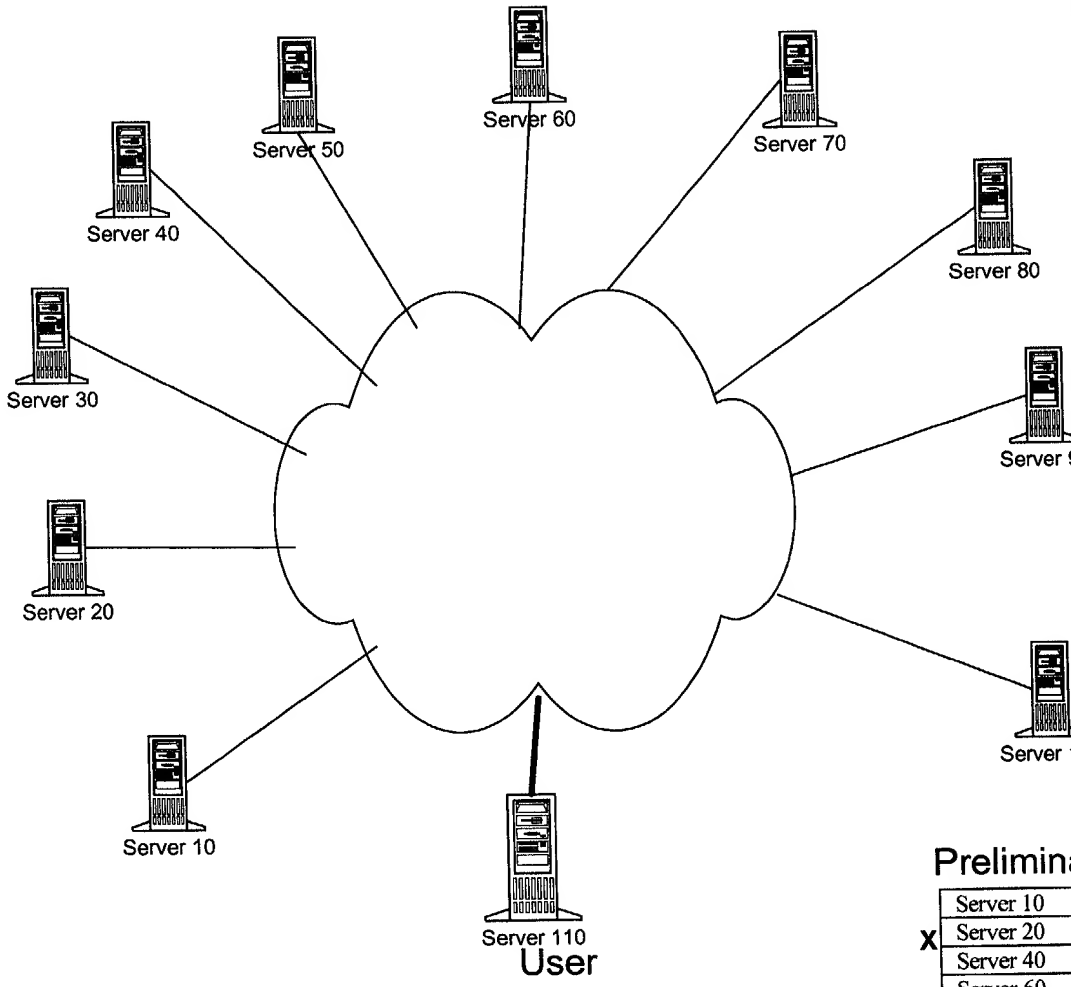
Figure 8



	Server 10	10 Gigabytes
X	Server 20	66 Gigabytes
	Server 40	15 Gigabytes
	Server 60	22 Gigabytes
X	Server 80	45 Gigabytes
	Server 100	22 Gigabytes

Server 110 discards certain server locations as undesireable for offloading.

Figure 9



Data on or accessible to User Server 110, to be stored on system-- Headers are attached to each data chunk

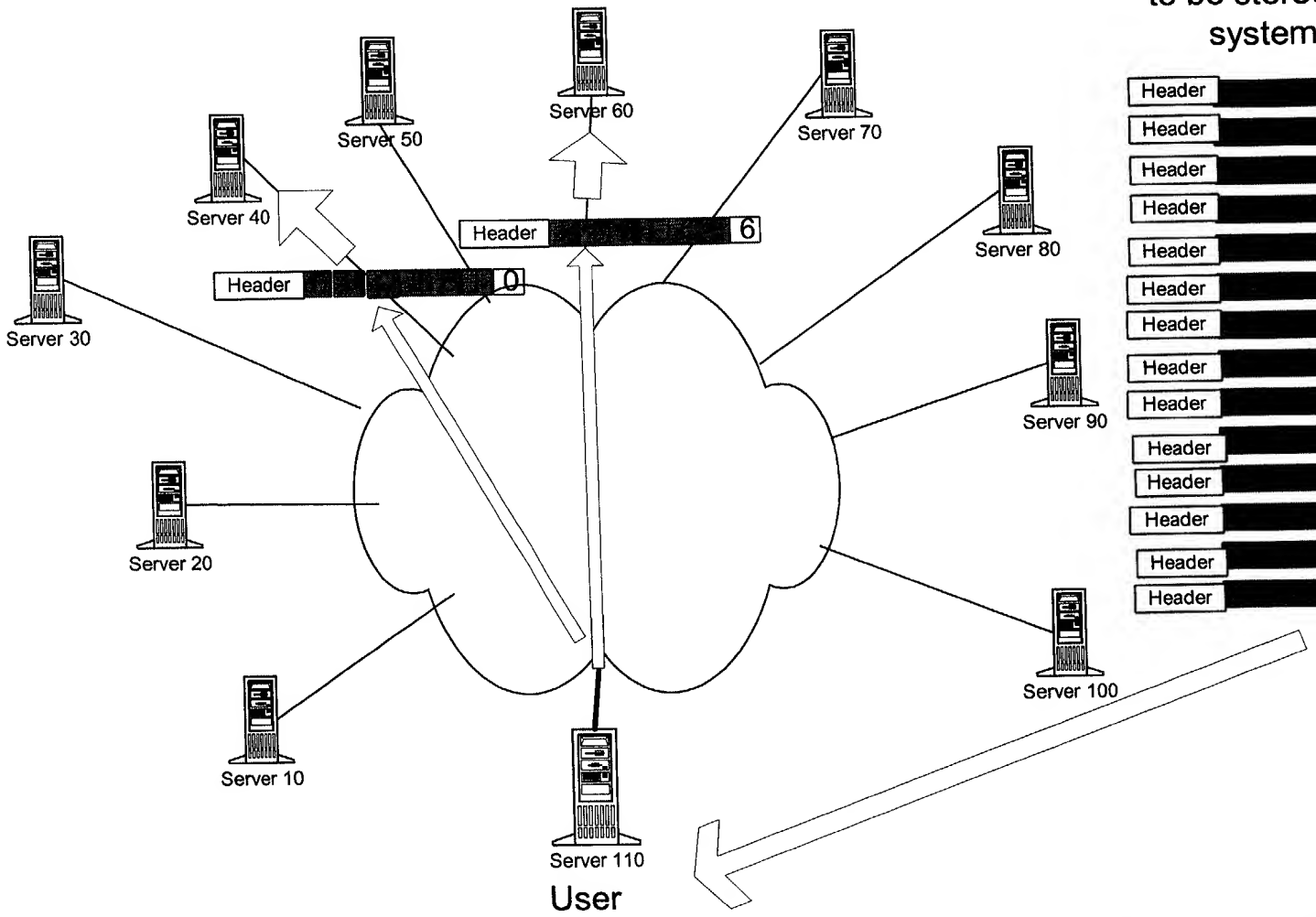
Header	1
Header	2
Header	#
Header	%
Header	d
Header	f
Header	k
Header	d
Header	2
Header	7
Header	8
Header	3
Header	$
Header	^
Header	6
Header	0

Preliminary FAT Table

	Server 10	10 Gigabytes
X	Server 20	66 Gigabytes
	Server 40	15 Gigabytes
	Server 60	22 Gigabytes
X	Server 80	45 Gigabytes
	Server 100	22 Gigabytes

Headers are attached to the data chunks, individually. The header identifies that the data belongs to Server 110, where the data is to be sent, where the data is to be resent for duplication, and how much the data needs to be chunked further at each vendor server location to further protect the data.

Figure 10



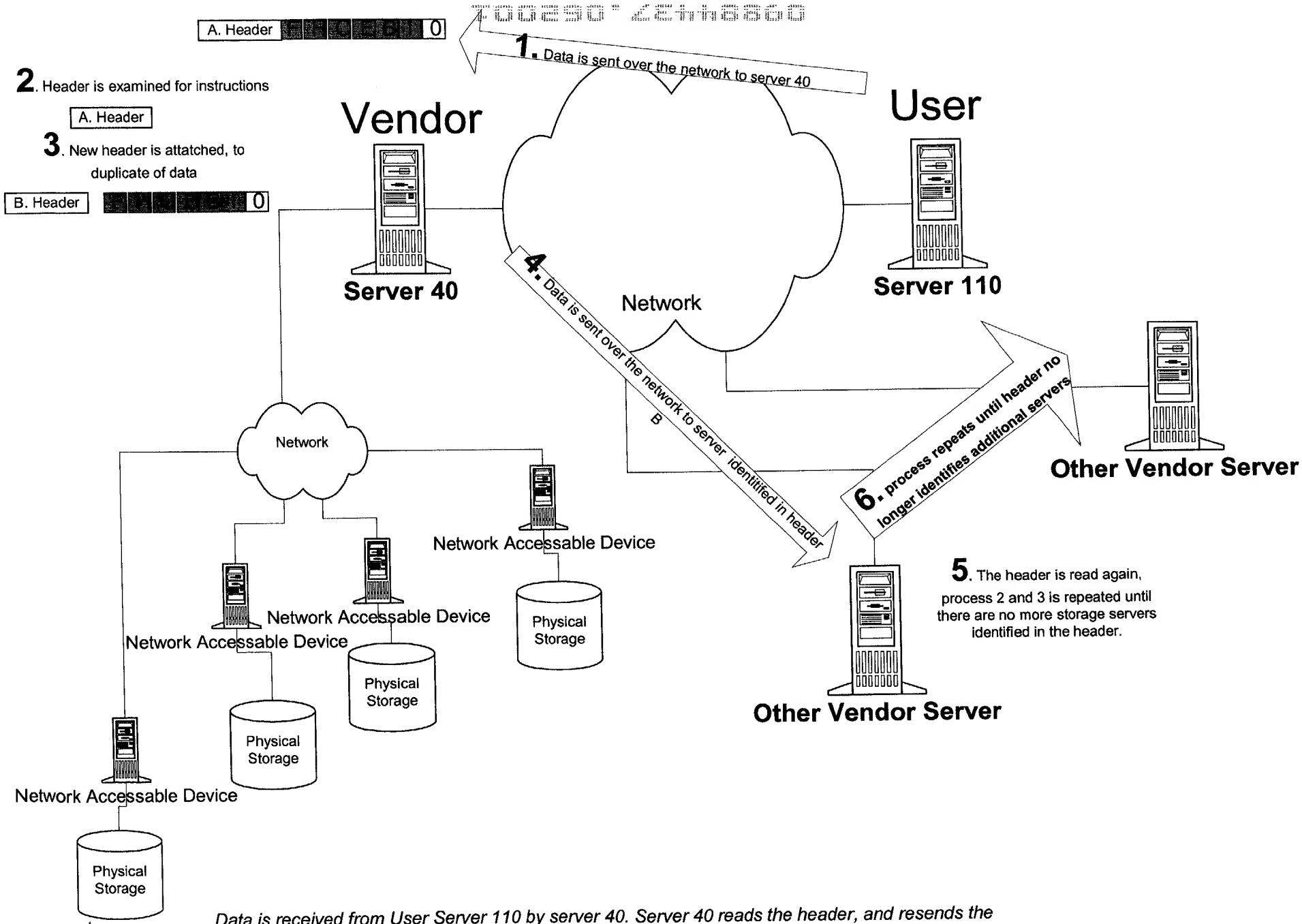
Data on or accessible to User Server 110, to be stored on system

Preliminary FAT Table

	Server 10	10 Gigabytes
X	Server 20	66 Gigabytes
	Server 40	15 Gigabytes
	Server 60	22 Gigabytes
X	Server 80	45 Gigabytes
	Server 100	22 Gigabytes

Server 110 sends data to servers for storage.

Figure 11



Data is received from User Server 110 by server 40. Server 40 reads the header, and resends the data chunk if the header identifies another location for the chunk to be delivered to, ie, another vendor server. Server 40 removes itself on the list of storage locations from the header, and reapplies the header to the data and resends the data.

Figure 12

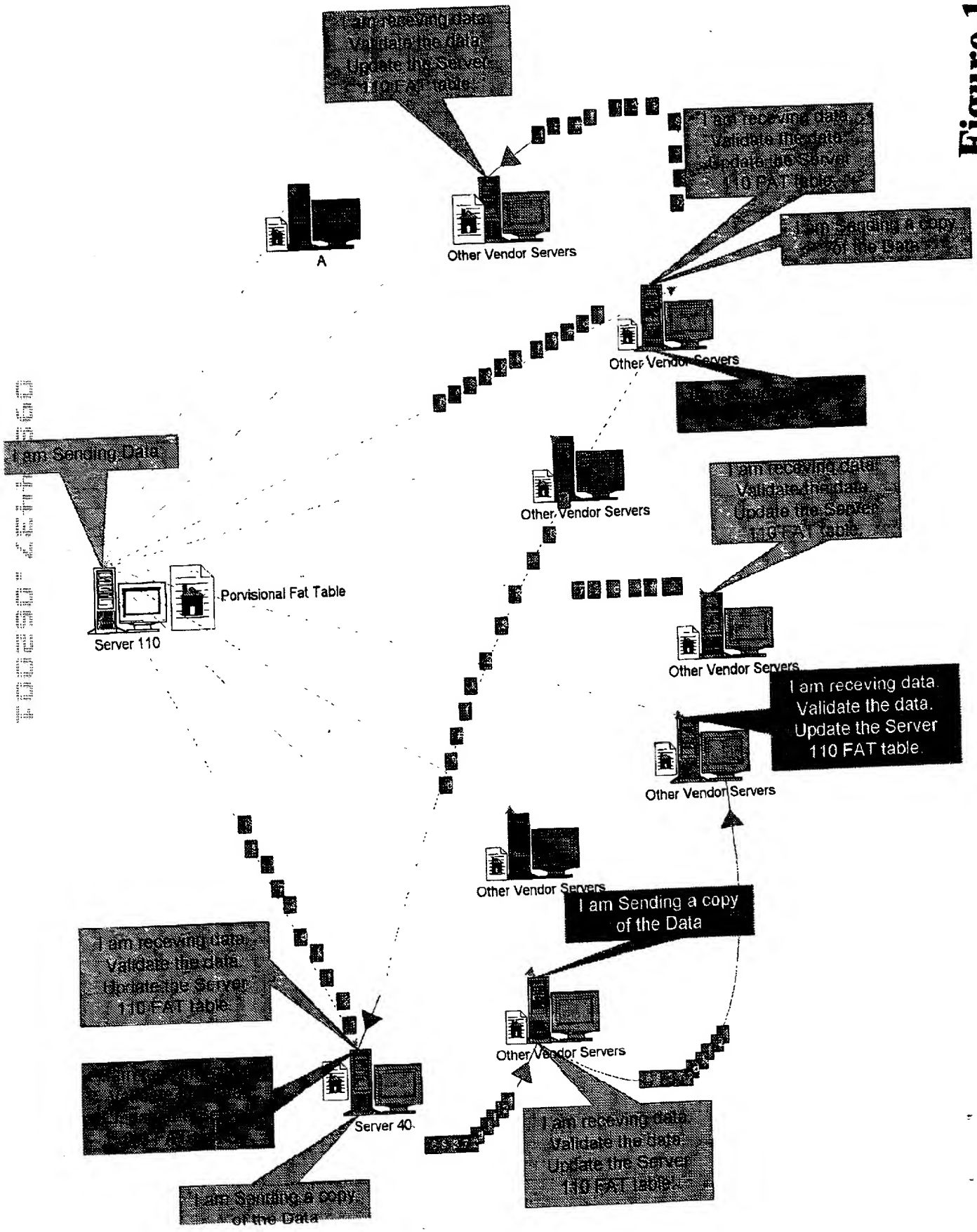
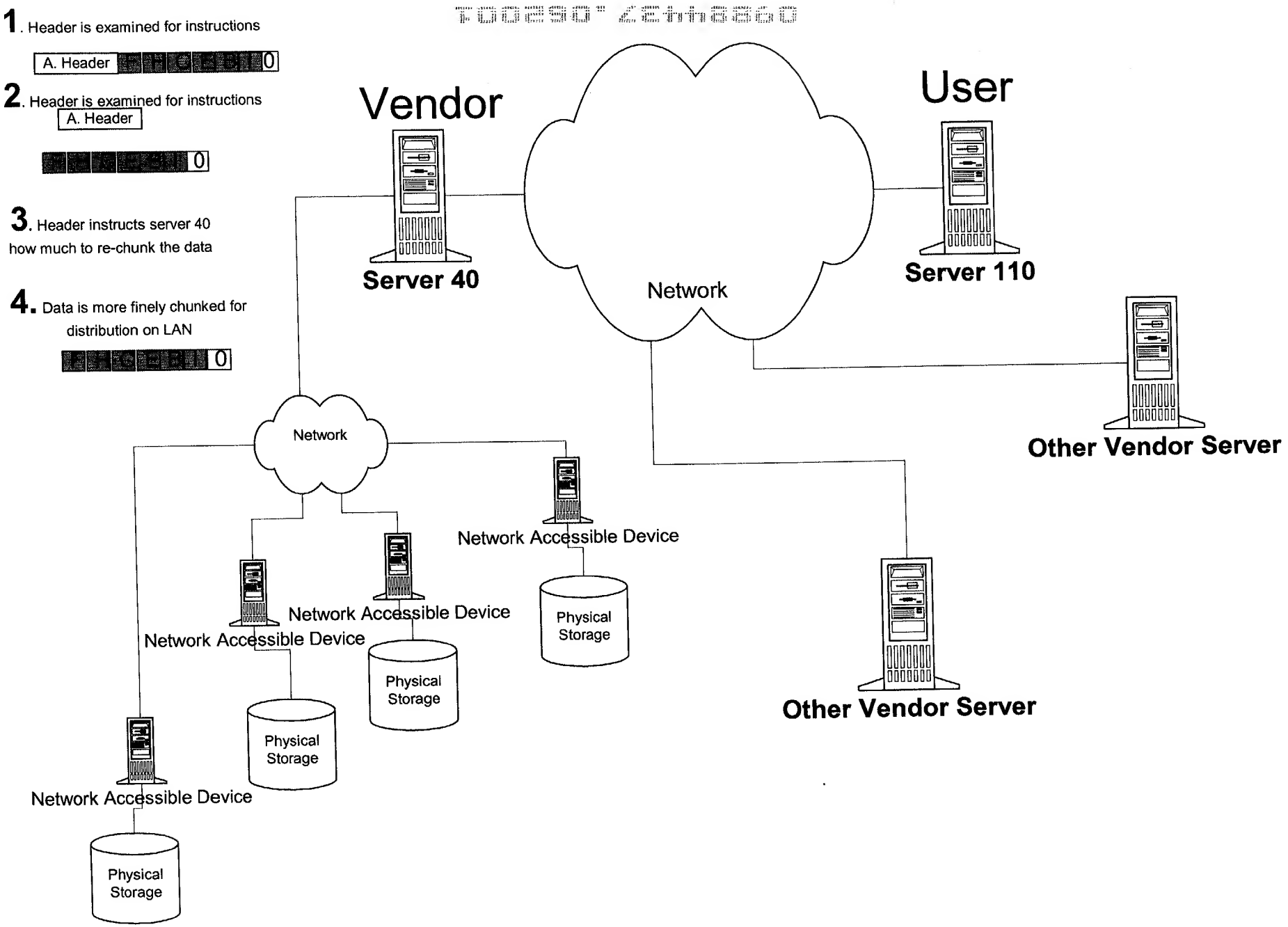

I am receiving data. Validate the data. Update the Server 110 FAT table.
A
Other Vendor Servers
I am receiving data. Validate the data. Update the Server 110 FAT table.
I am Sending a copy of the Data
Other Vendor Servers
I am Sending Data
Other Vendor Servers
I am receiving data. Validate the data. Update the Server 110 FAT table.
Porvisional Fat Table
Server 110
Other Vendor Servers
I am receving data. Validate the data. Update the Server 110 FAT table.
Other Vendor Servers
I am Sending a copy of the Data
I am receving data. Validate the data. Update the Server 110 FAT table.
Other Vendor Servers
Server 40
I am Sending a copy of the Data
I am receving data. Validate the Data. Update the Server 110 FAT table.

Figure 12a

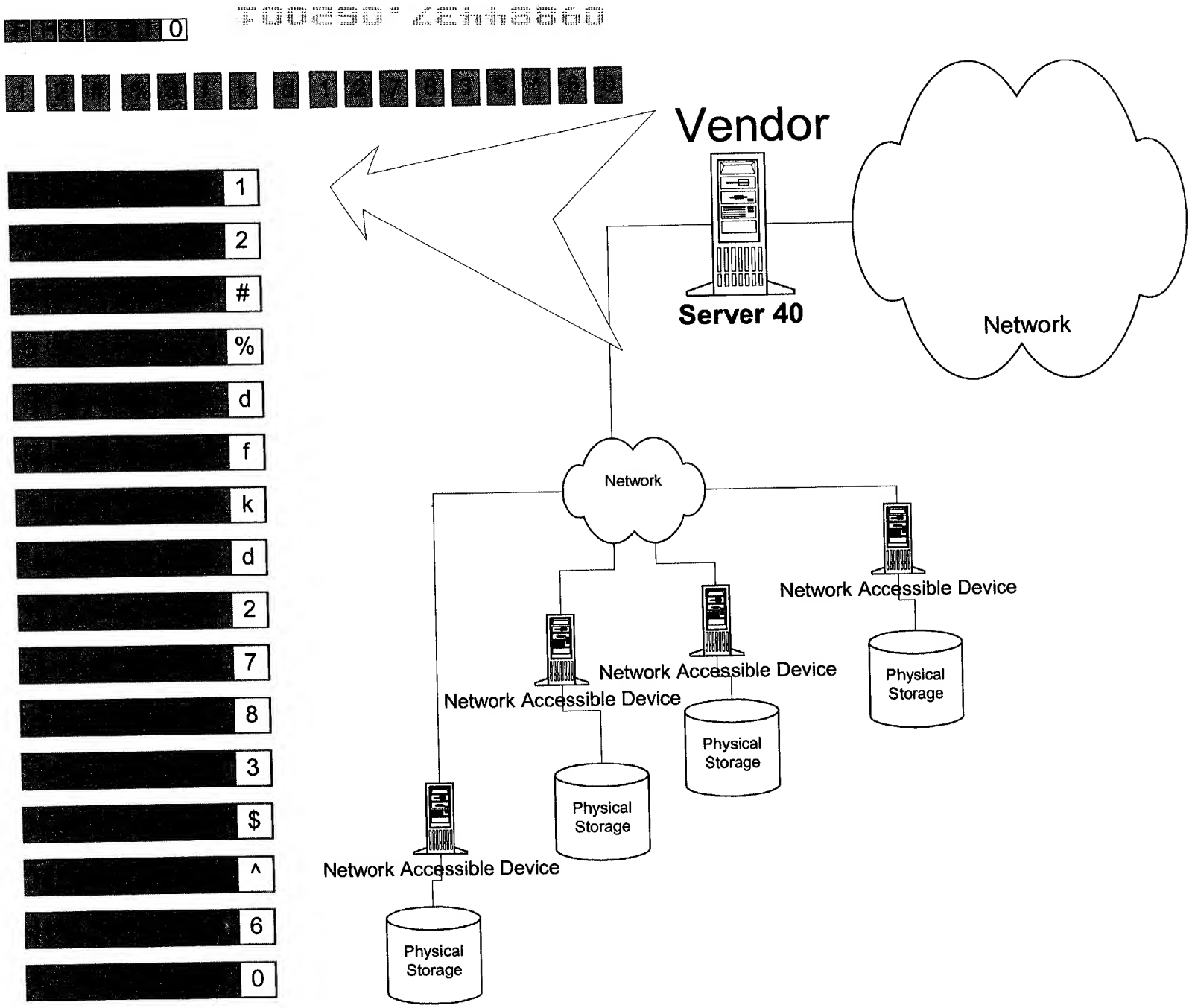


Data is received from Server 110 by Server 40, and is prepared for distribution on the server 40 network.

Figure 13a

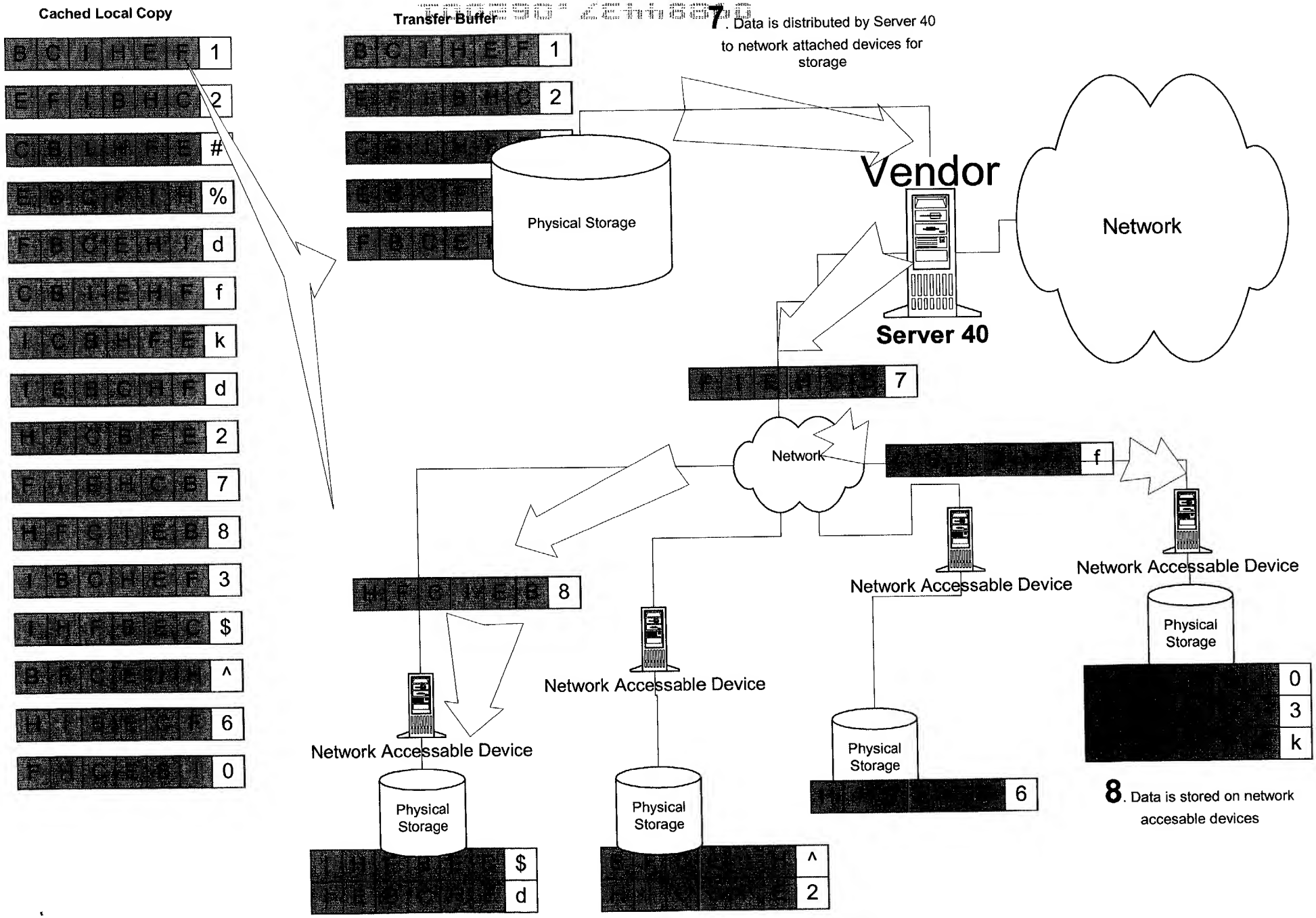
5. Data is more finely chunked by Server 40 for delivery on LAN

6. Data is encapsulated by Server 40 with protocol for retreival, identification, and distribution, etc.



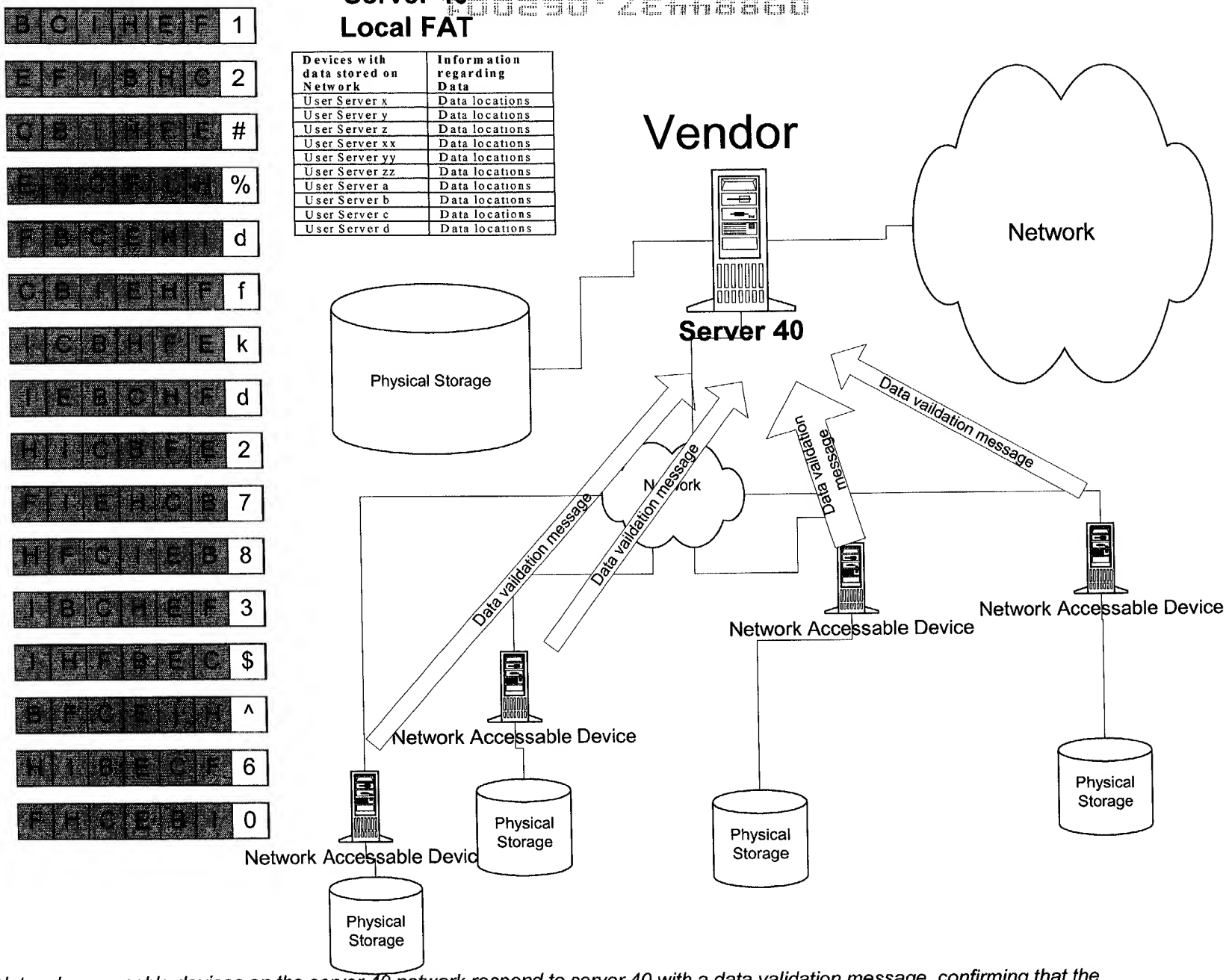
Server 40 reads in the header the instructions as to how much to re-chunk the data before distribution on the Server 40 network. Server 40 will rechunk the data at least as much as the header requests.

Figure 13b



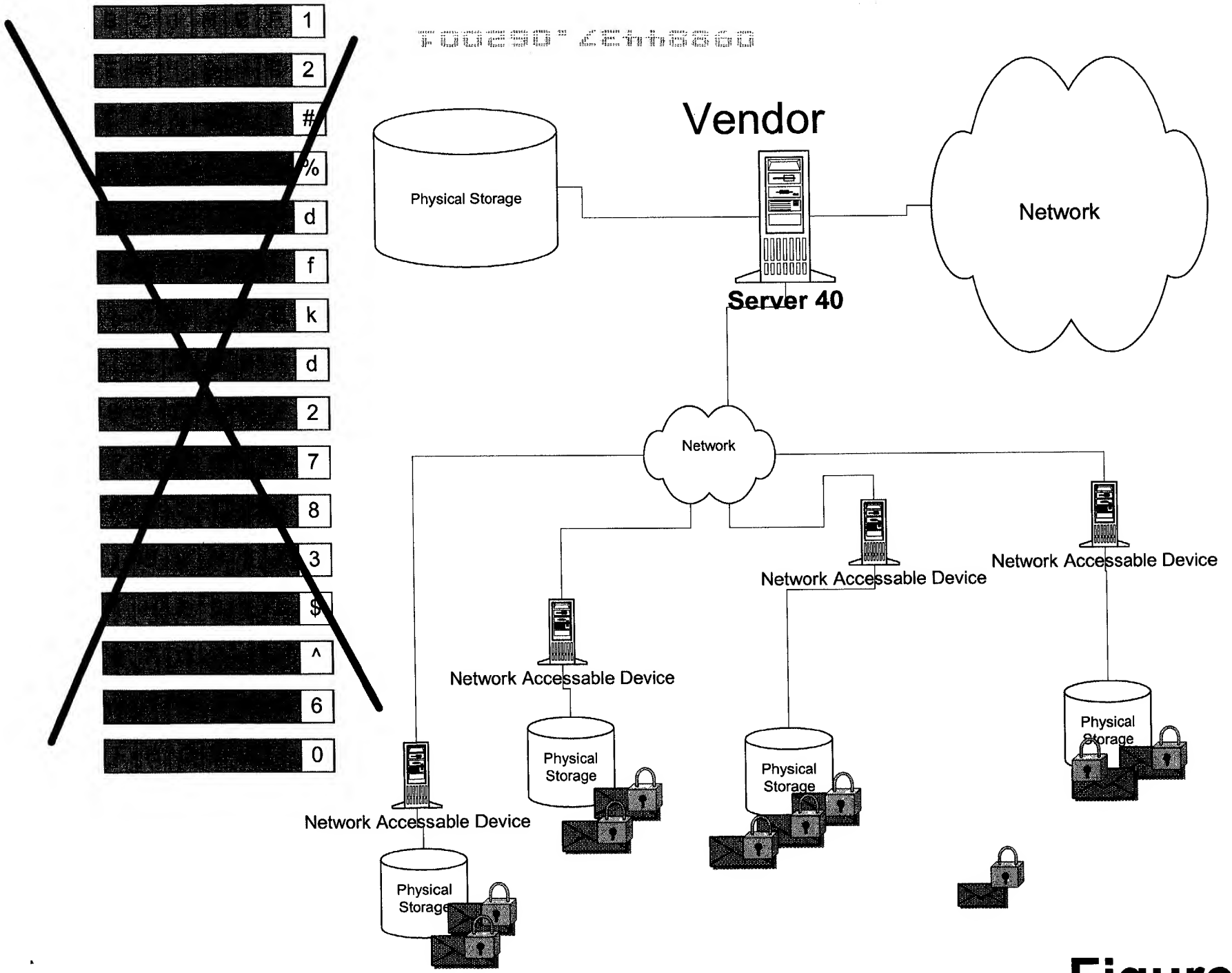
Server 40 sends server 110's data to the network accessable devices for storage.

Figure 13c



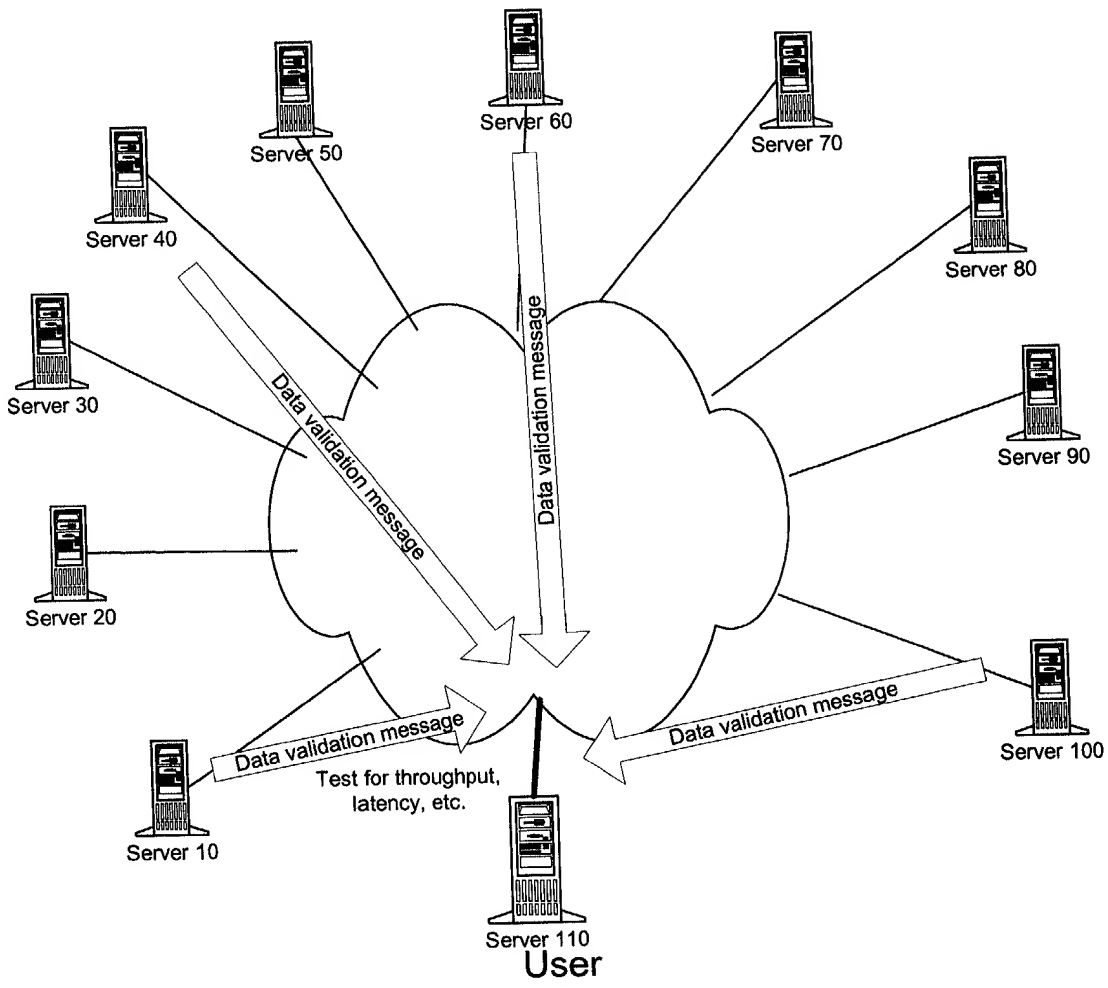
Network accessable devices on the server 40 network respond to server 40 with a data validation message, confirming that the data was successfully stored. If no data validation message returns for a particular data chunk, the chunk is either resent or sent to a different device on the server 40 network. Server 40 compiles and stores local File allocation table for the data stored on the Server 40 network

Figure 13c



Server 40 receives validation messages from Network accessable devices, and is free to erase the Server 40 local copy of the data. Server 40 maintains a record of where the data resides.

Figure 13e

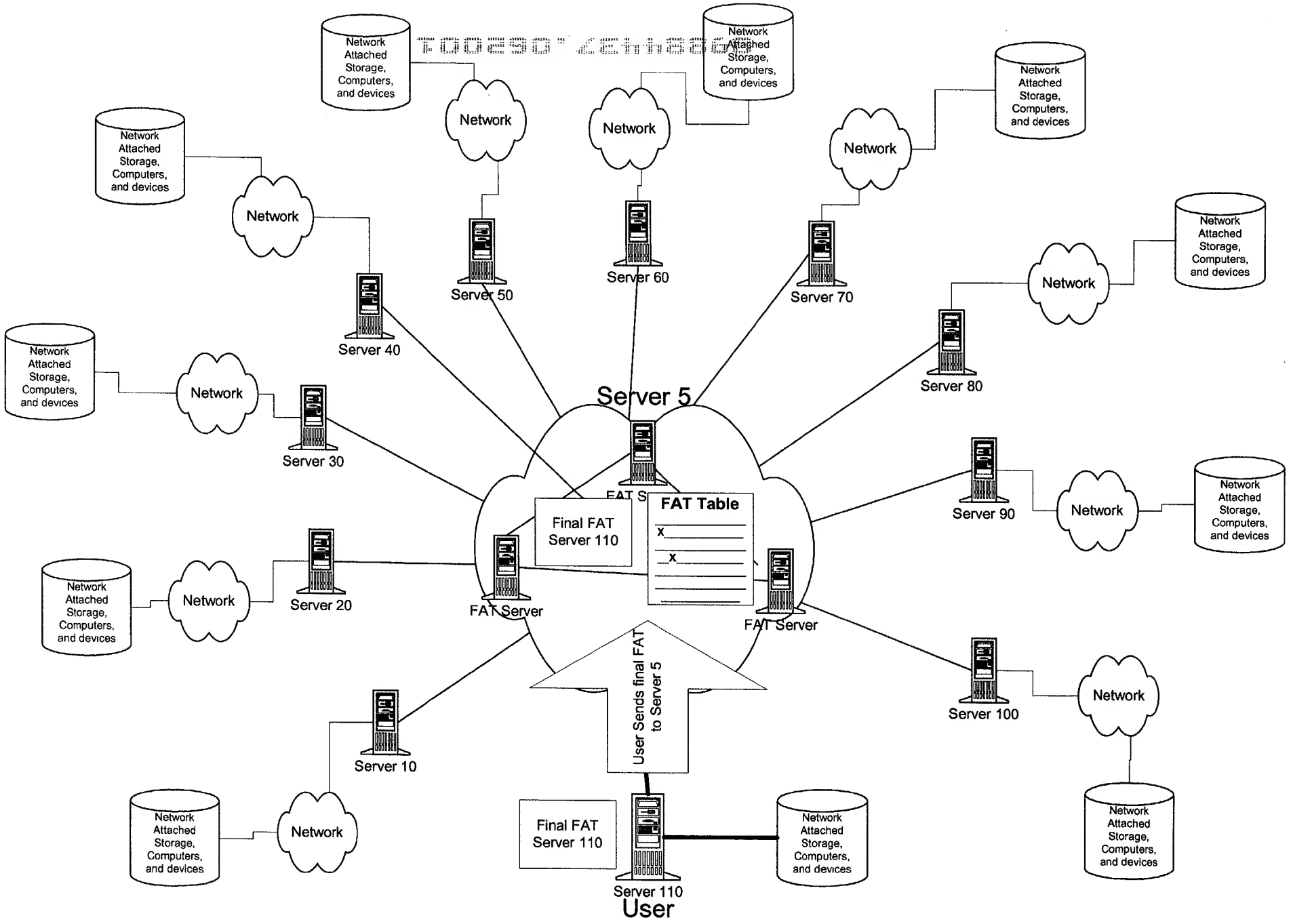


Preliminary FAT Table

	Server 10	10 Gigabytes
X	Server 20	66 Gigabytes
	Server 40	15 Gigabytes
	Server 60	22 Gigabytes
X	Server 80	45 Gigabytes
	Server 100	22 Gigabytes

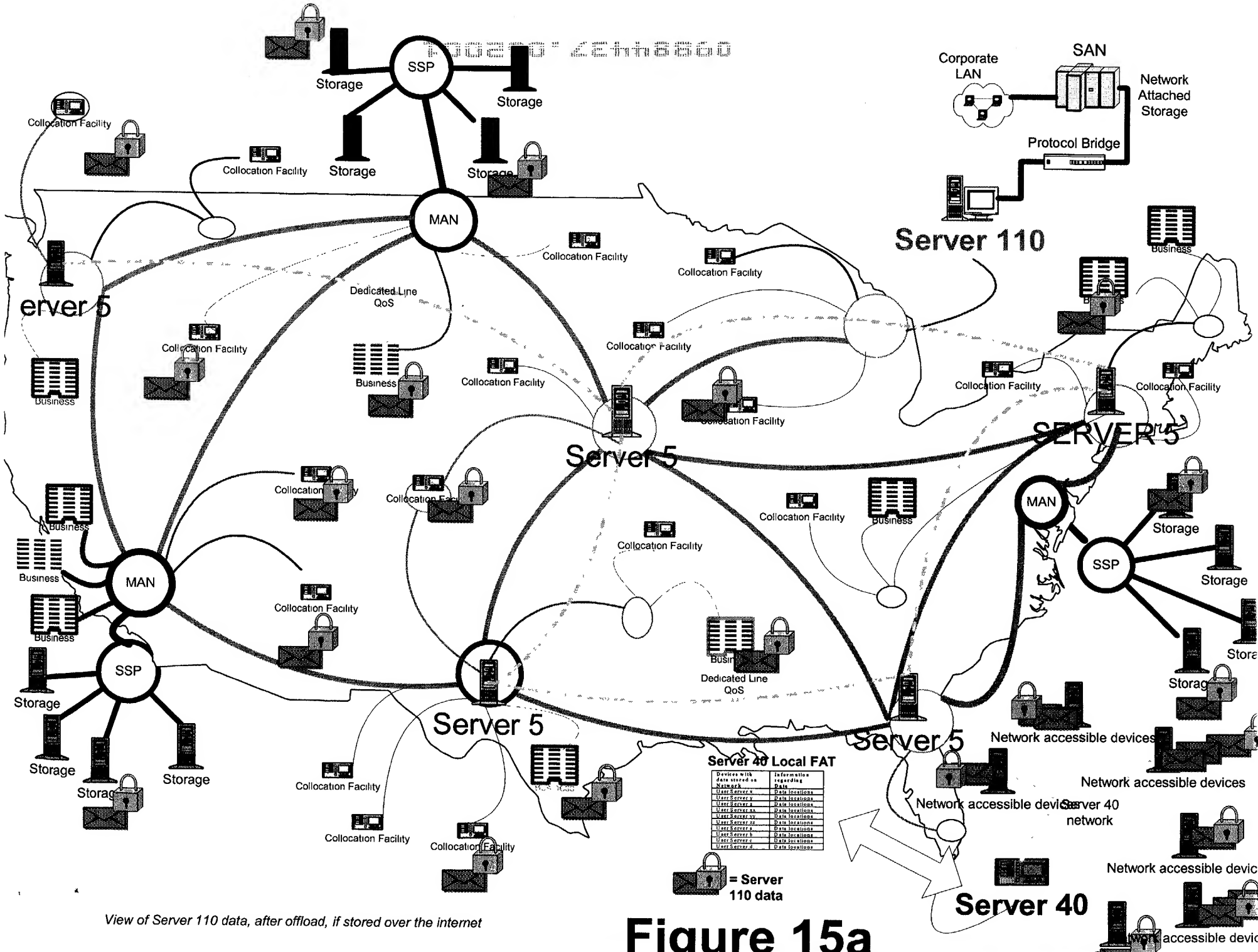
Servers providing storage report back to user to validate that the data was stored successfully. If unsuccessful , or a vendor servers is not heard from, then the data will be resent to a new location, and the location will be marked as unused on the preliminary FAT table.

Figure 14



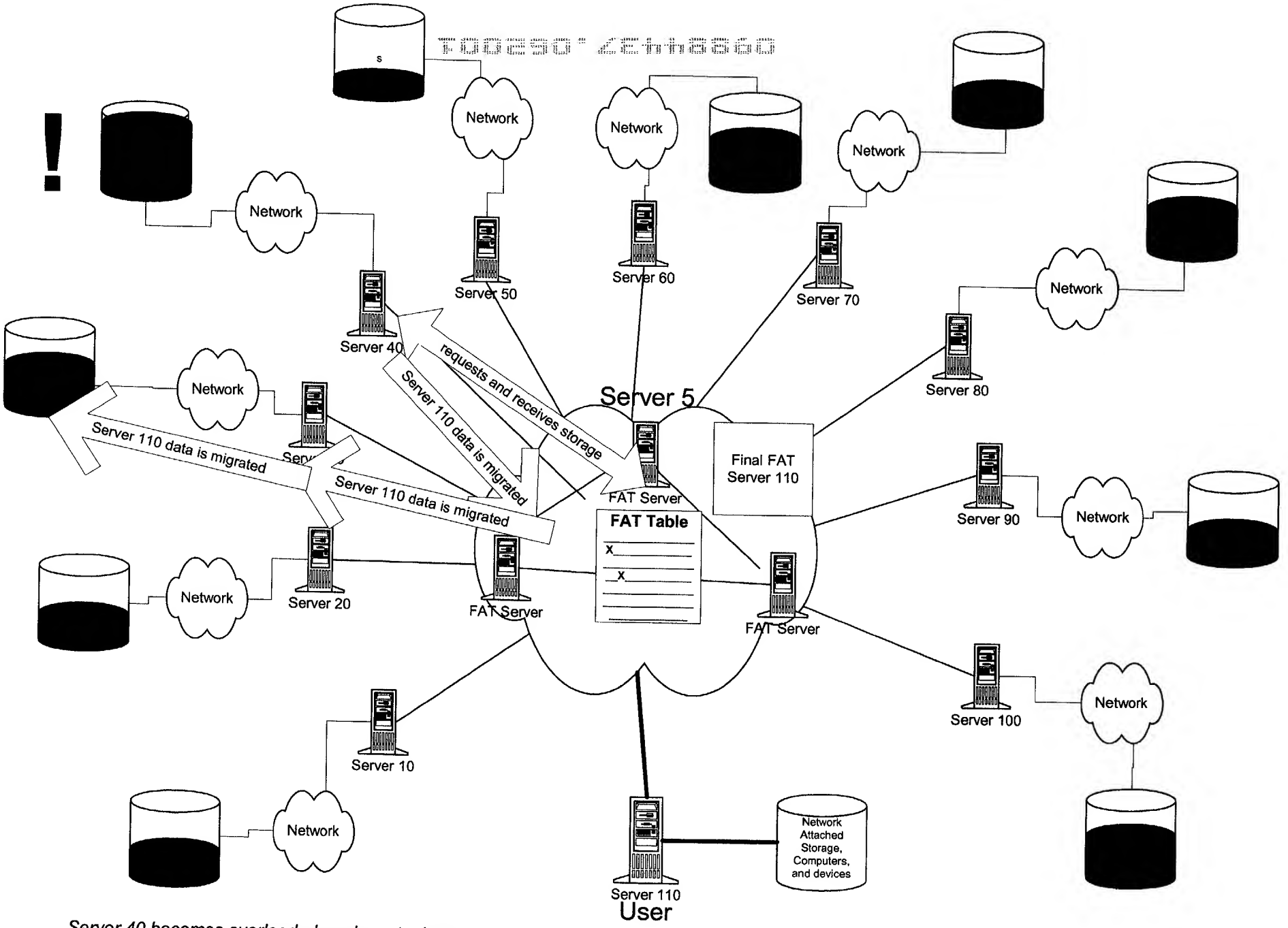
Server 110 compiles a final FAT, identifying where the data finally was stored successfully. Server 110 sends the final FAT table to Server 5 for storage for when Server 110 wishes to download the data back to Server 110 at a later time. Server 5 checks the final FAT, and releases as usable by other Users any location on the Final FAT that Server 110 did not use. Server 5 marks as "used" any server resources allocated and used by Server 110

Figure 15



View of Server 110 data, after offload, if stored over the internet

Figure 15a



Server 40 becomes overloaded, and must migrate server 110 data, so server 40 requests storage from server 5. Server 5 allocates storage from the FAT table. After the data has migrated and is validated, Server 5 updates the final fat table for server 110.

Figure 15b

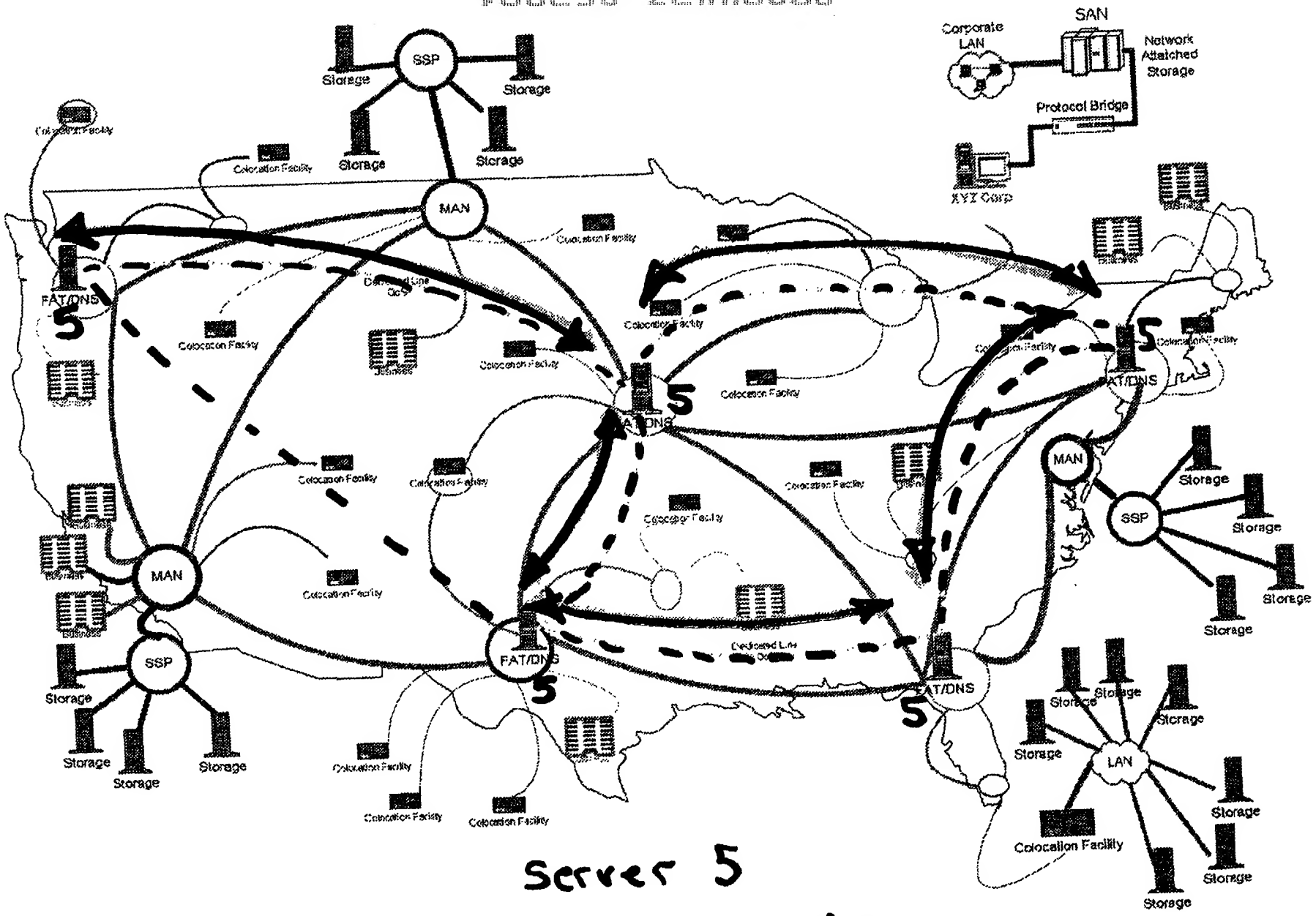

SSP
Storage
Storage
Storage
Storage
SAN
Corporate LAN
Network Attached Storage
Protocol Bridge
XYZ Corp
MAN
FAT/DNS
5
Colocation Facility
Dedicated Line
MAN
SSP
Storage
Storage
Storage
Storage
Storage
Storage
Storage
Storage
Storage
Storage
Storage
Storage
LAN
Colocation Facility
Server 5
----- = Private Network

Figure 15c

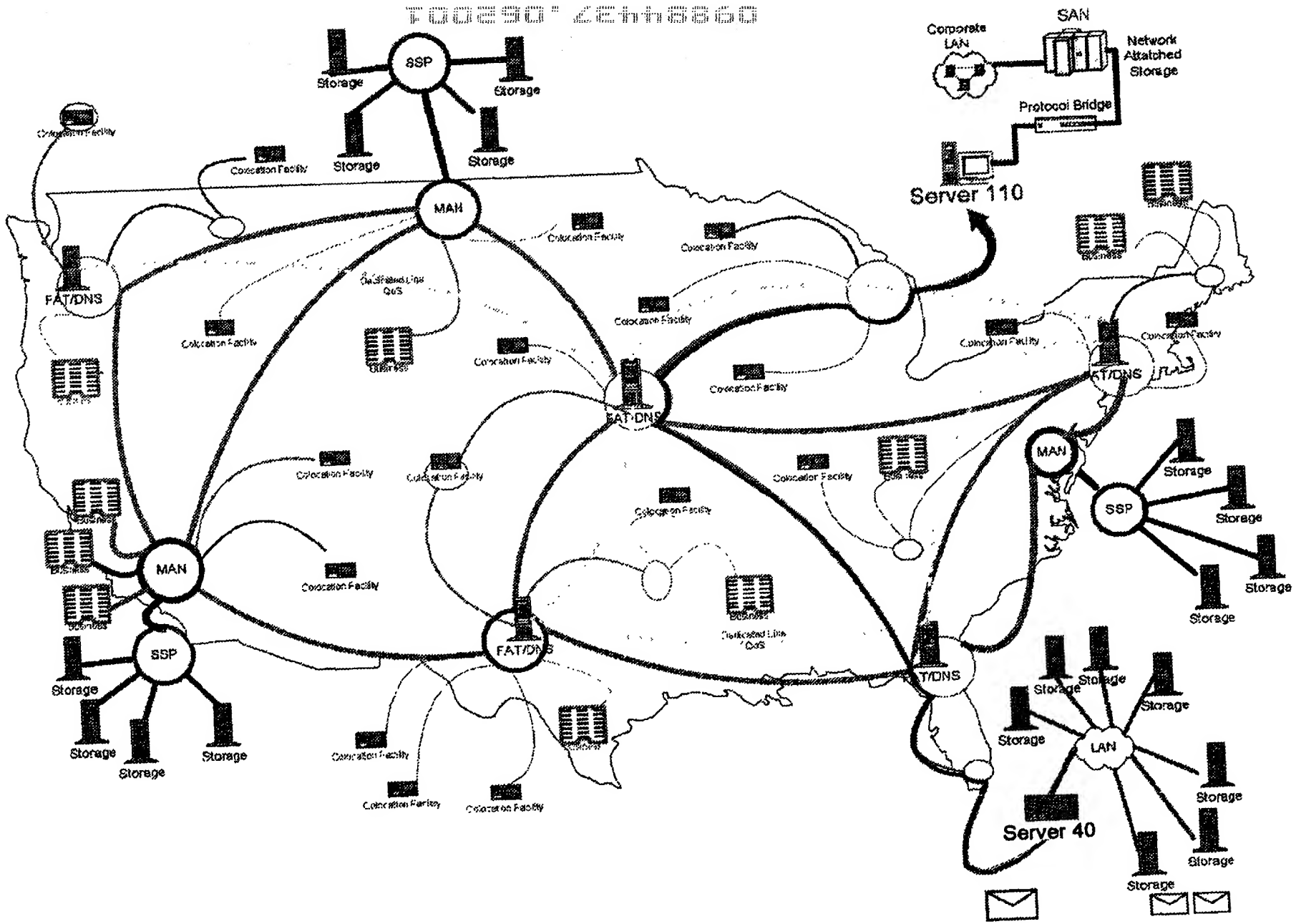

SAN
Corporate LAN
Network Attached Storage
Protocol Bridge
Server 110
SSP
Storage
MAN
FAT/DNS
Collocation Facility
Dedicated Line QoS
LAN
Server 40

Figure 15d

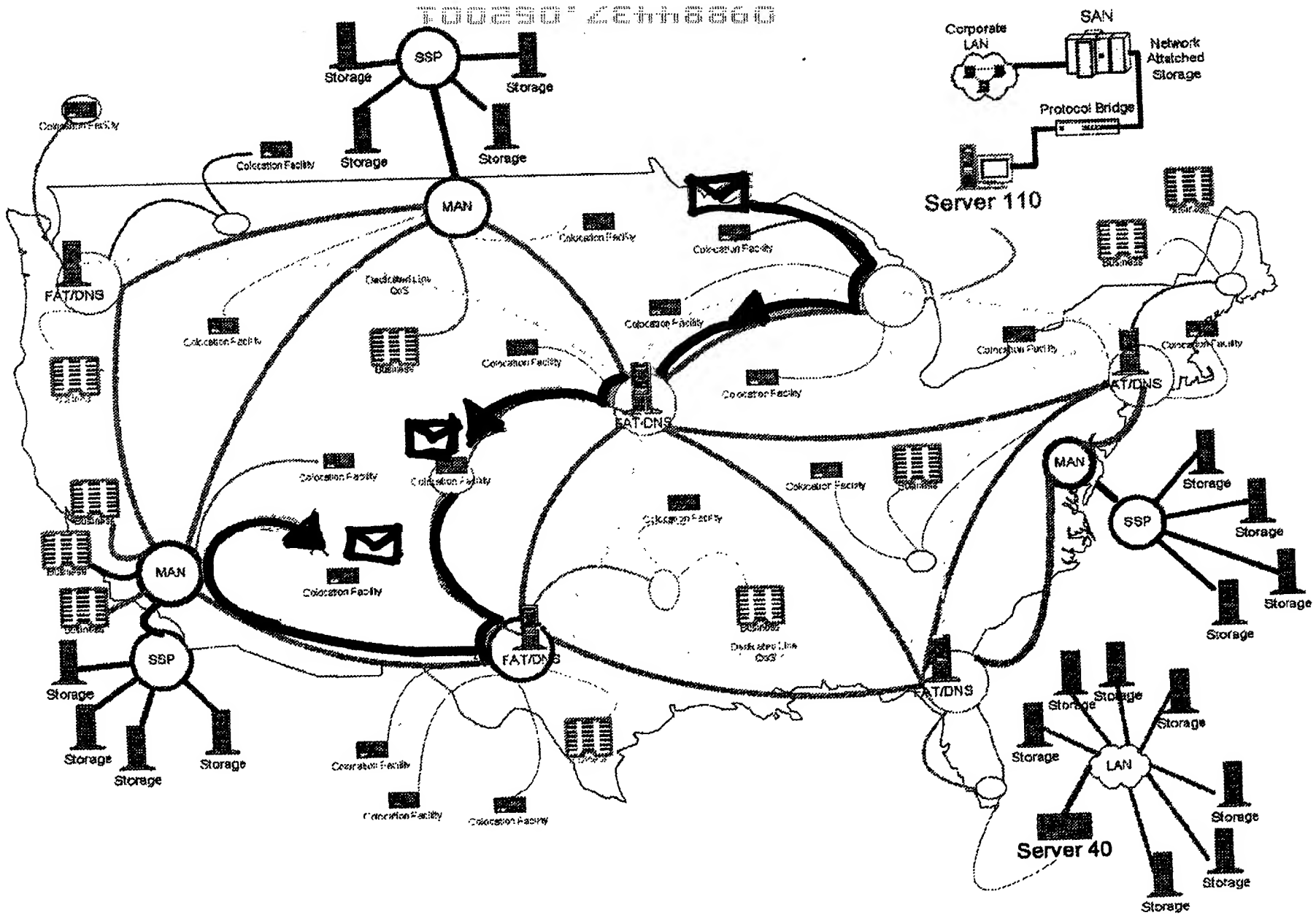
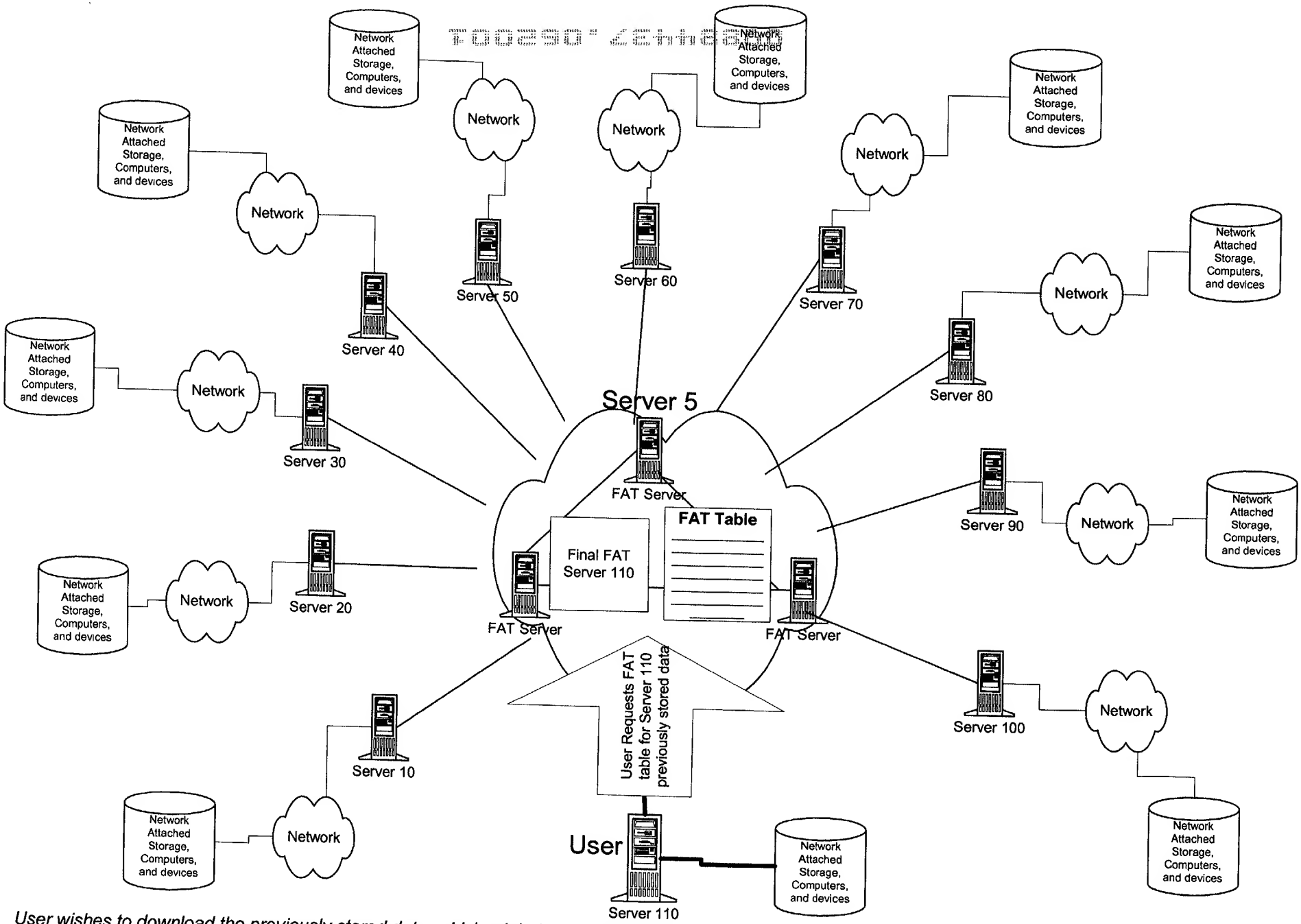
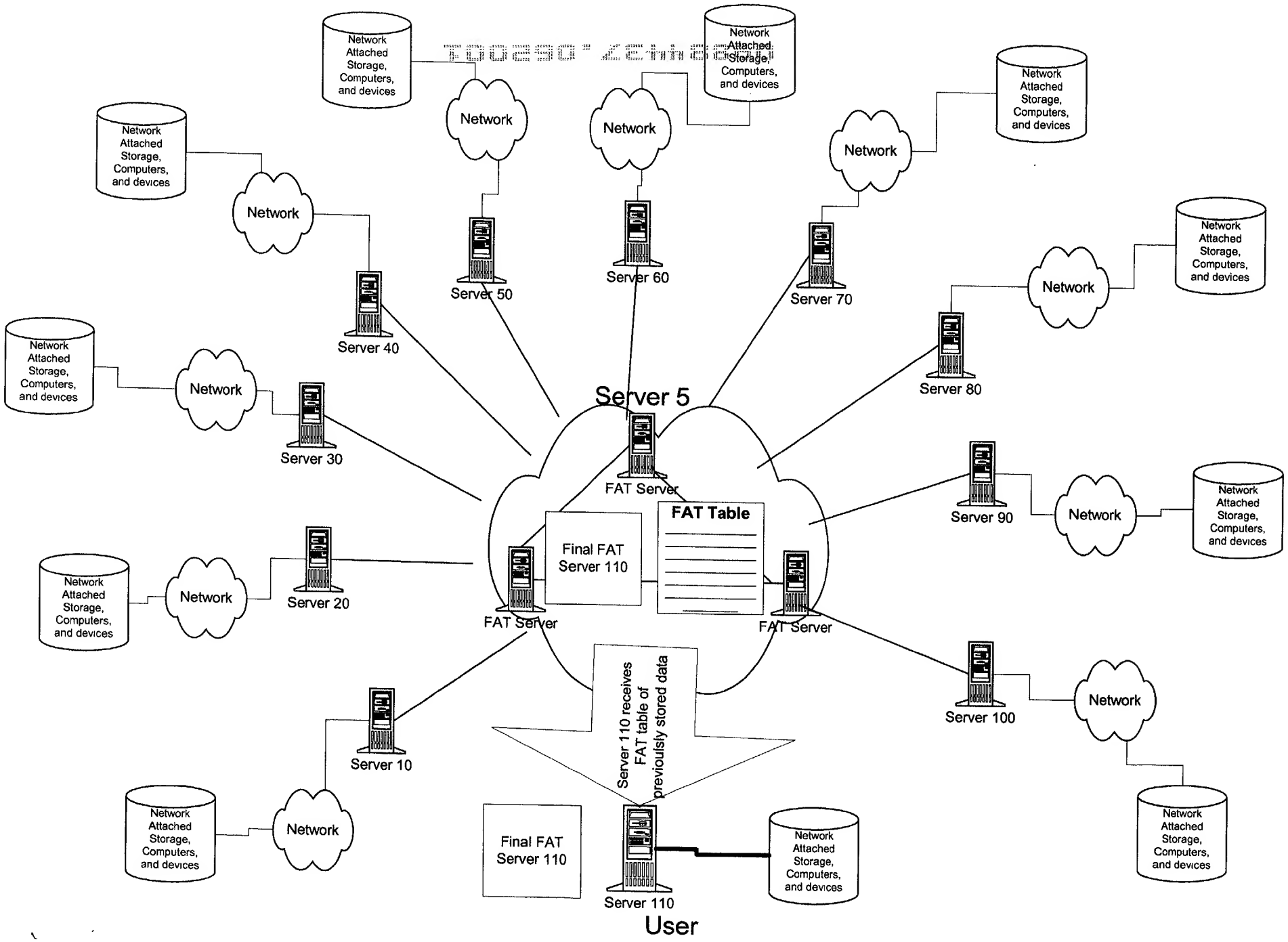

SSP
Storage
Storage
Storage
Storage
Corporate LAN
SAN
Network Attached Storage
Protocol Bridge
Server 110
Colocation Facility
MAN
FAT/DNS
Dedicated Line QoS
Business
MAN
SSP
Storage
Storage
Storage
Storage
FAT/DNS
FAT/DNS
FAT/DNS
MAN
SSP
Storage
Storage
Storage
Storage
LAN
Storage
Storage
Storage
Storage
Server 40

Figure 15e



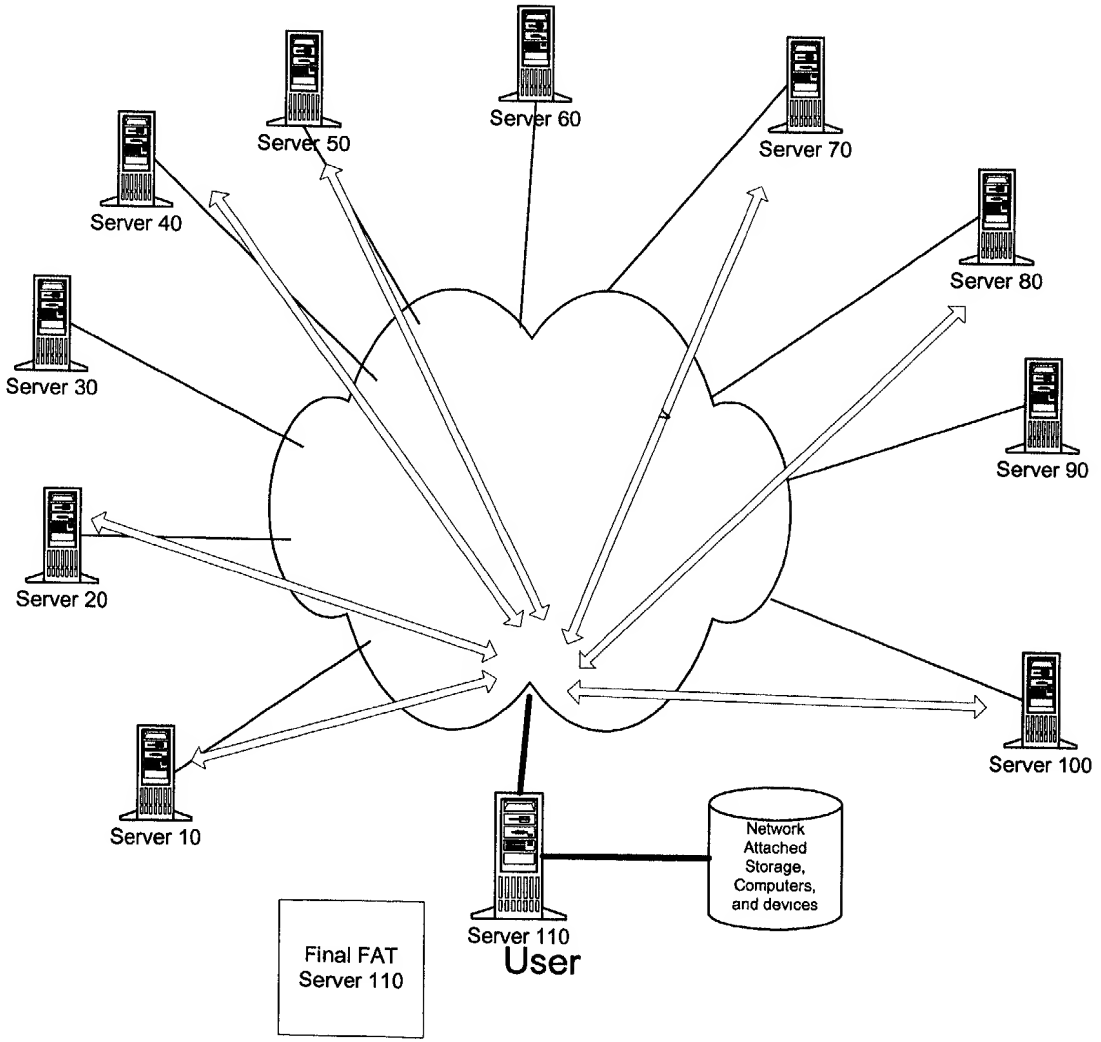
User wishes to download the previously stored data, which might have migrated since it was offloaded to various servers. User therefore logs onto the Server 5 and requests the authoritative FAT table that indicates where the Server 110 data resides. In the period since server 110 offloaded the data, the data might have migrated due to overloaded conditions on a particular vendor service, in which case the overloaded server would request a storage location from server 5 (as previously shown), and would have moved the data.

Figure 16



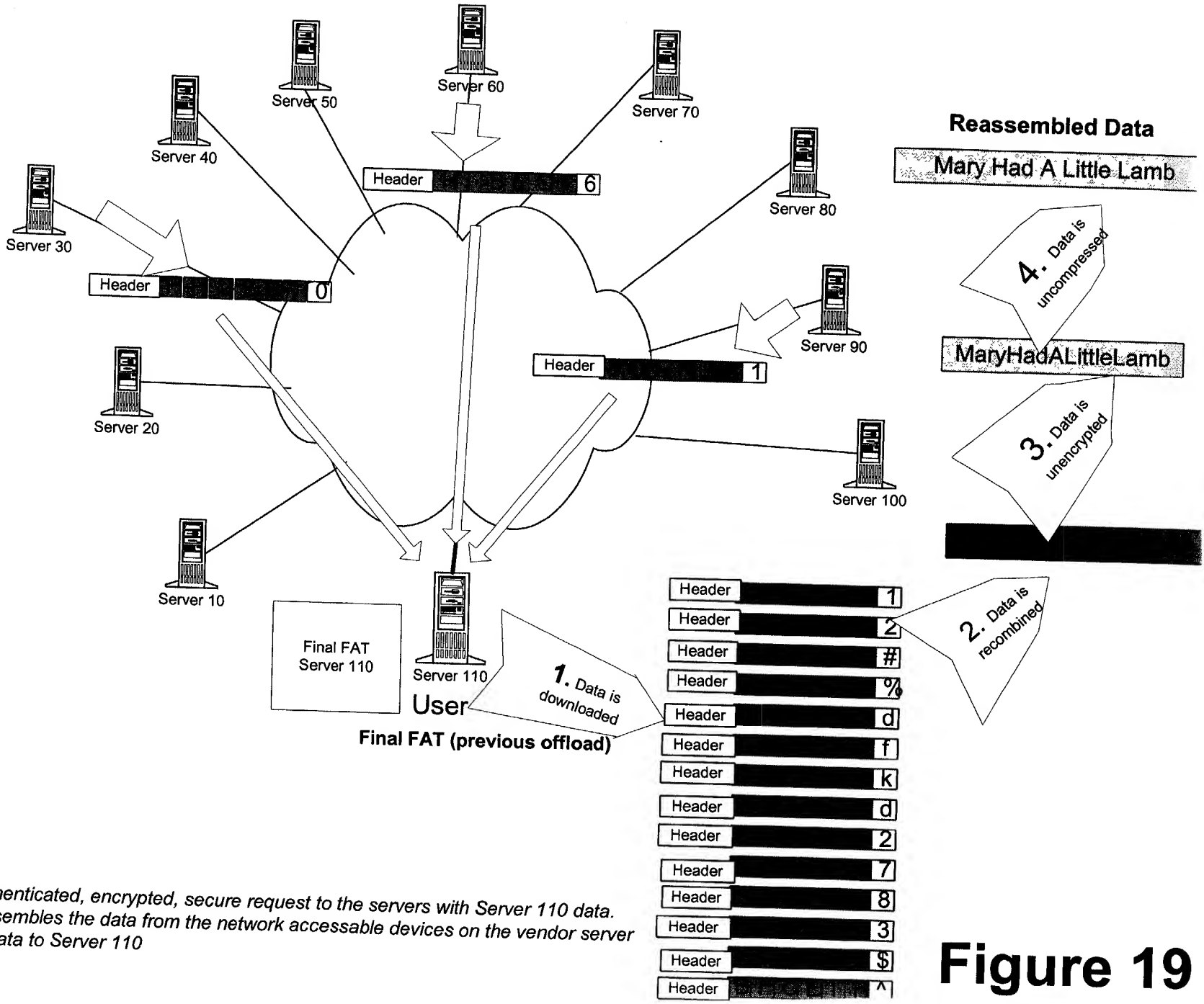
Server 110 Sends for and receives its FAT table for all locations of its data, even the duplicate locations for each data chunk.

Figure 17



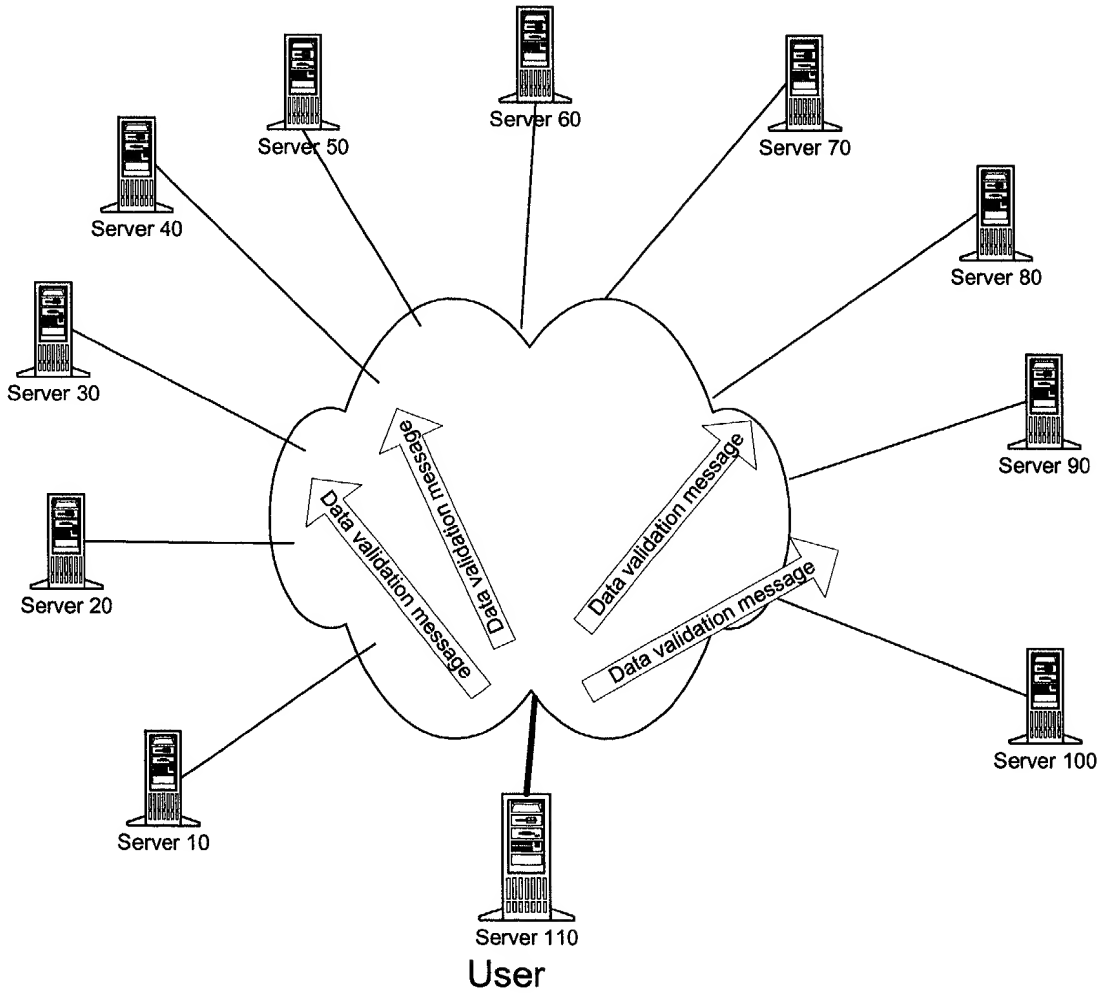
The user, Server 110, searches for an optimum path to download the data.

Figure 18



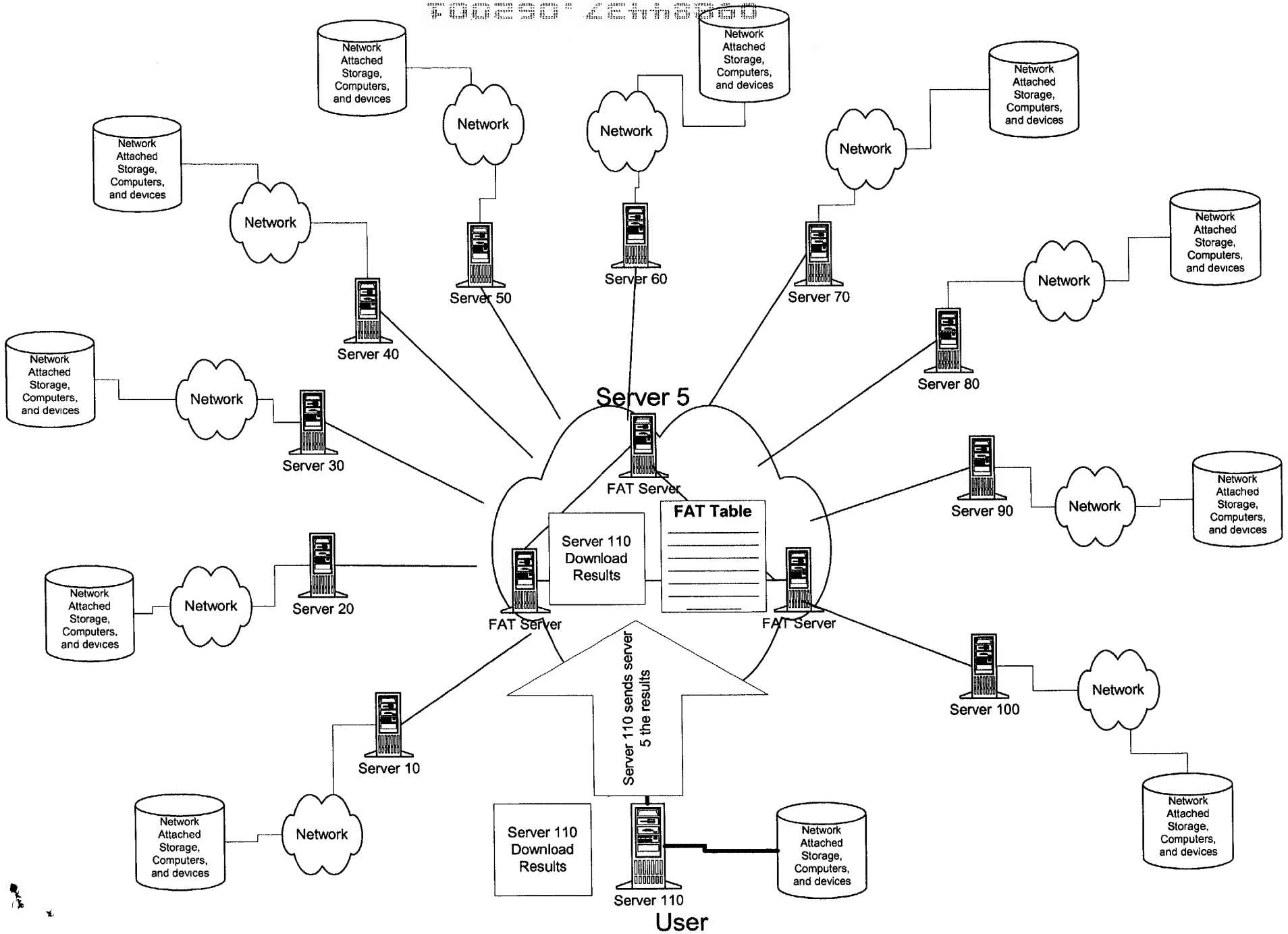
Server 110 sends an authenticated, encrypted, secure request to the servers with Server 110 data. Each vendor server reassembles the data from the network accessable devices on the vendor server network, and sends the data to Server 110

Figure 19



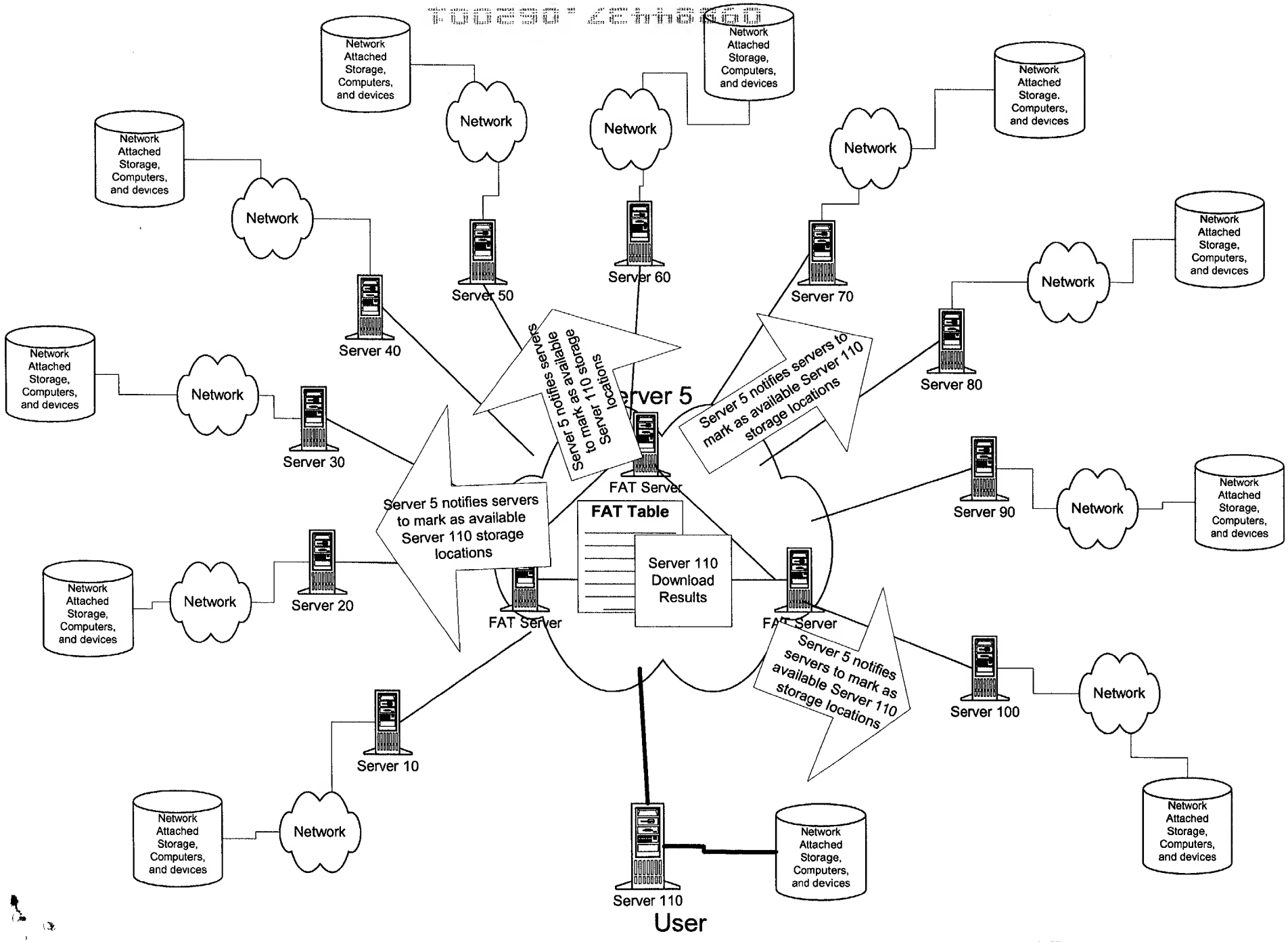
Server 110 sends a data validation message to each of the vendor servers from which it successfully downloaded Server 110 data, confirming that the data was received.

Figure 20



Server 110 sends Server 5 the results of its download so that server 5 can reallocate the storage resources previously used by server 110.

Figure 21



Server 5 notifies the vendor servers that had stored the server 110 data, indicating that the vendor servers can erase the resources previously used by server 110.

Figure 22